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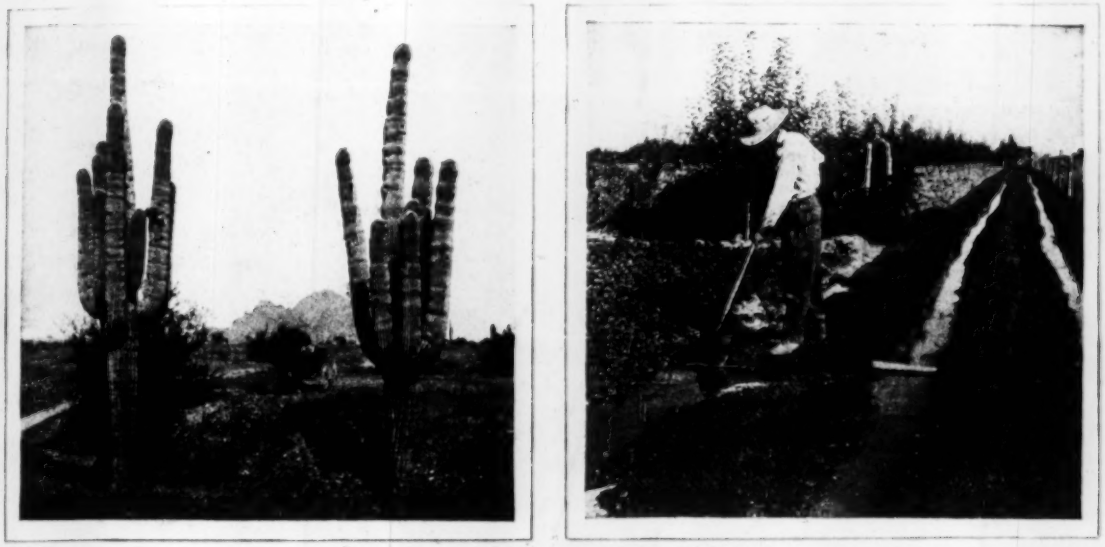
Engineering News-Record

Beginning in this issue a series of articles on

Federal Reclamation; A National Problem



Western Desert Land Before and After Irrigation

In this issue, the first article

Origin, Problems and Achievements of Federal Land Reclamation

By F. H. Newell

Formerly Director, U. S. Reclamation Service

gives the background of the U. S. Reclamation Service, how it came to be formed and what it has done

NEXT WEEK:

Development of the West Under Irrigation

By C. E. Grunsky

Consulting Engineer, San Francisco

COMING ARTICLES:

Agriculture on Irrigated Lands

By Carl S. Scofield

Agriculturist, U. S. Department of Agriculture

Twenty Years of Reclamation

By F. H. Newell

Formerly Director, U. S. Reclamation Service

and further articles on financing, settlement, marketing and operation of irrigation projects

Also in this issue: **Notes from the reclamation country**

By F. E. Schmitt, of the editorial staff of *Engineering News-Record*

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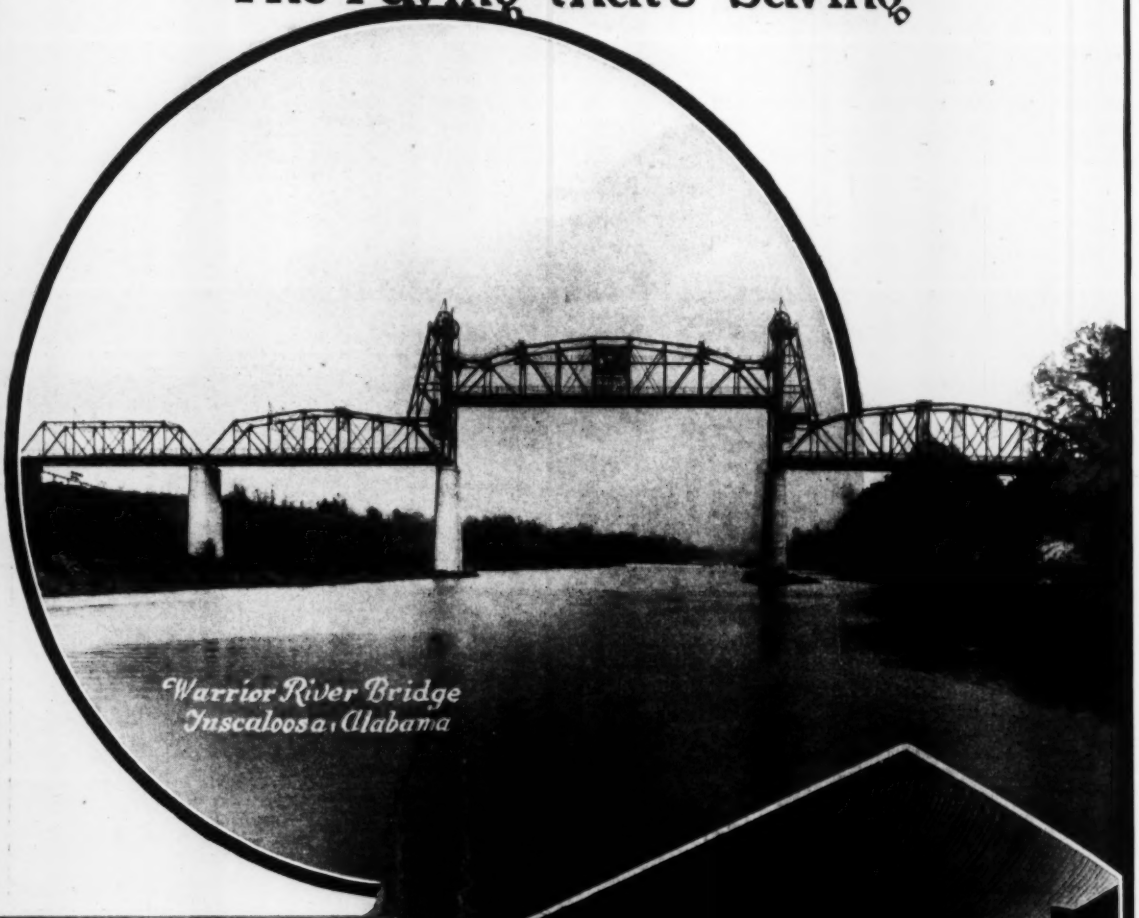

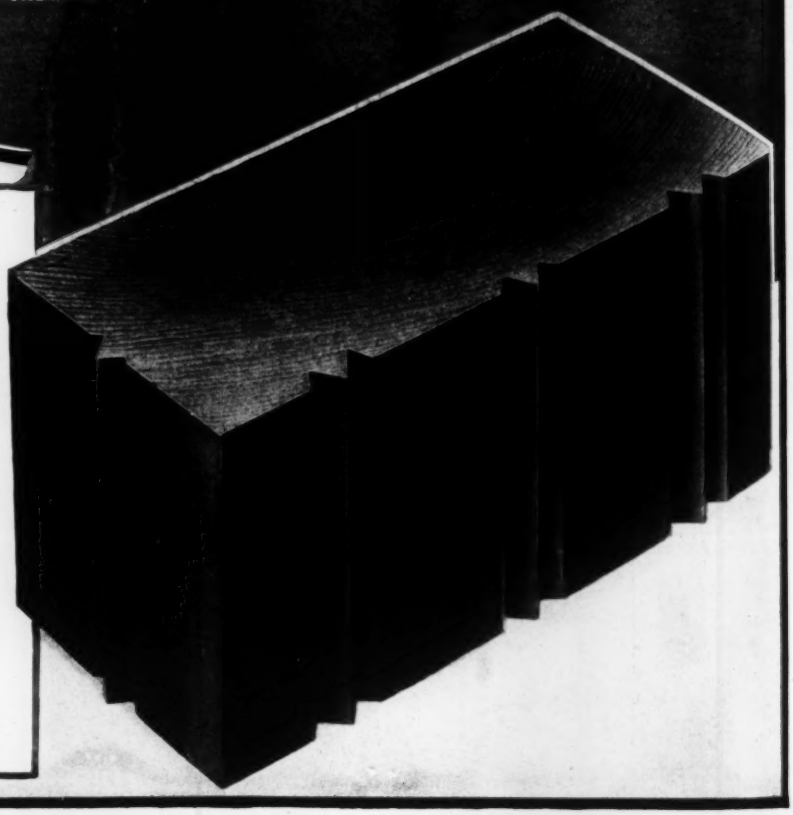

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ENGINEERING NEWS-RECORD

DEVOTED TO CIVIL ENGINEERING AND CONTRACTING

E. J. MEHREN, *Editor*
FRANK C. WIGHT, *Managing Editor*

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When Water Is Missed

IT'S a severe drought that does not do some good. In northeastern New Jersey many communities that had long postponed joining Newark in the development of the Wanaque supply have taken decisive action since the accumulated deficiency in this year's rainfall has caused serious water shortage in adjacent territory. In northeastern Massachusetts, too, a number of communities have been short of water of late. Some of these have been helped out from the Boston Metropolitan supply—sharply emphasizing their possible dereliction in not having joined the district long ago as well as bringing home to the whole district the fact that it, too, may be short of water if it does not go further afield at once. New York City began none too soon on its Schoharie Creek enlargement, this year's low rainfall and the low stage of the Ashokan reservoir indicate. The Hackensack Water Co., which supplies over fifty New Jersey municipalities in Hudson and Bergen counties, has an immense reservoir about ready for service. It showed foresight in building this. Had it not been for presumably unavoidable delays in its completion this reservoir might have made it unnecessary for the company to cut off the supply to dozens of industrial plants last week, thus throwing thousands out of work. All these things bring home to the people and the municipal authorities, what every engineer well knows, that in times of plenty of water money and other means should be provided to guard against droughts, for water is sadly missed when the well runs dry.

Earthquakes and Modern Structures

ENGINEERS who have been awaiting details as to the effect on engineering structures of Japan's earthquake tragedy of Sept. 1 will find the first authoritative engineering information in the report, elsewhere in this issue, by John W. Doty and W. W. Johnston, president and engineer, respectively, of The Foundation Co., New York. While conditions after the catastrophe prevented an exhaustive technical study of all structures demolished or standing, it was possible for these two American engineers to make a rapid survey of what the quake did in both Japan's capital and one of its principal seaports 18 miles distant. The most significant message Mr. Doty brings back from the Orient is that modern building design can produce structures which will stand up even when subjected to a test as severe as that of the Japanese earthquake last month. In such design, however, swaybracing must be extremely heavy and the various elements of the structure, particularly the floors and side walls, must be securely tied together to resist the battering ram effects of a severe and sustained seismic shock. Structural adequacy, however, is only a part of the story. An examination of the devastated areas in the Japanese cities indicates that the fire which followed the quake was responsible for a considerable portion of the destruction. The engineering lesson of the quake, therefore, must include a realization of the need, in any large city, subject to shocks, of fire prevention zones. In the rebuilding of the stricken cities it is certain that the authorities will prohibit, or at least minimize, the flimsy, top-heavy structure, and will lay out new work in accordance with a plan which will provide fire stops where needed. The government's first move toward these ends was the recent issuance of orders prohibiting the erection of any but temporary structures without a permit from the state.

Improved Road Contracts Again

CONTRACTUAL policies in highway construction were agreed upon a year ago by a joint committee of the Associated General Contractors and Association of State Highway Officials. They established a distinct advance in fair dealing. There remains the task of translating these approved policies into actual practices by state highway departments. This has already been done in some states. The results are satisfactory. One, therefore, is not proposing unprecedented action in asking that the joint committee, which has remained in existence and will next month go into conference to formulate its report, shall require that its conclusions shall be made articulate in state specifications and contracts for road construction. Until this is done generally the agreement reached last year is only a gesture. Such futilities have been too common in the work of contractors and engineers toward improvements in contract practice. In the road improvement of a decade to come the two have to work together in public service. If the agreement made a year ago is wise let it be enforced; if it is not wise let it be altered. Inaction is not worthy of either association.

Asphalt Simplified

ASPHALT simplification by the reduction to ten in the grades or varieties called for in specifications for street road work is now an accomplished fact. The Department of Commerce has just announced that, as a result of endorsement of the ten standard grades (as determined by penetration limits) by most of the state highway departments the leading engineering and specification-making organizations of the country and a substantial majority of the important producing companies, the new standards become effective Jan. 1, 1924, and form the Commerce Department's "Simplified Practice Recommendation No. 4—Asphalt." The new scale of grades (see *Engineering News-Record*, Oct. 18 p. 658) represents the joint recommendation of consumers and producers. It replaces the 50 or 100 different grades which it has been the practice to specify in the past. The obligation of highway engineers and contractors, however, does not end with the attachment of an O. K. to a report. The full fruits of the various asphalt conferences which have been held in Washington during the past year will be realized only if the asphalt users

specify, in their orders, one or more of the standard grades of material. The range of standard penetration limits adopted is sufficient to provide for every reasonable requirement of traffic or temperature.

Three in the Field

NOW that a sanitary section has been organized in the American Society of Civil Engineers there are three organizations depending almost wholly upon the same group of men for support. The two others are the State Sanitary Engineers and the Sanitary Engineering Section of the American Public Health Association. The meeting of the latter at Boston two weeks ago was so well attended—perhaps a hundred in all—and the four sessions, including the special conference on the treasury water standard, were so successful as to leave no question about there being a place for that organization. The State Sanitary Engineers have a distinctive field, being made up of the chief engineers of state health departments and a limited representation from the United States Public Health Service. As the newcomer in the field, the Sanitary Section of the Am. Soc. C. E. is on trial. However, the success of the informal dinners attended for the past few years by the sanitary engineers afford reason for believing that the more formal section will justify its existence, provided its meetings are judiciously handled in view of the existence of the other two organizations.

Water Pollution and Industrial Wastes

FOR many years past the problem of protecting the natural waters of the country from pollution by industrial wastes has been growing in seriousness. While there have been notable instances of progress, for the most part these have been isolated. From the viewpoint of governmental control, whether local, state, or federal, comparatively little has been accomplished beyond a long series of investigations and reports that have pointed the way to better things. Perhaps the greatest hindrance to progress has been the halting state legislation for the control of the pollution of waters by industrial wastes. There have been plenty of instances of sweeping prohibition of water pollution of any kind, but rarely has a statute been enacted that was, after all, much more than a formality since it is a well-known maxim that legislation without means of enforcement is futile.

Most of such legislation as has been enacted by our states has vested some degree of stream pollution control by industrial wastes in state boards or departments of health. Aside from the indefiniteness of some of this legislation and the lack of means of enforcement in nearly all cases, state health departments have been loath to undertake control of industrial wastes. This has been due to fear of political interference in case sufficiently strong action was taken to lead important industries of the state to expect great expense and trouble; and fear that the commotion thus stirred up might seriously interfere with work more vitally affecting the public health. To this, there may be added the inherent difficulties and complexities of the problem due both to the technical difficulties involved in treating many classes of industrial wastes and due also to an honest and legitimate concern for the industries themselves lest they be burdened with expense that might in extreme cases even drive them out of business.

Who should bear the burden of protecting our natural waters from pollution by industrial wastes? Some who fail or are unwilling to see that the growth of both city population and of industry makes impossible the keeping of many of our streams in what, to use the favorite phrase, is their "pristine purity," advocate unthinking and unreasonable extremes. If, instead of following them, a sane policy is pursued, there is no question but what the cost of adequate measures for protection in this field should enter into the legitimate cost of the products of industry and be met by the ultimate consumer. But so long as attempts to prevent water pollution by industrial wastes have been scattered here and there throughout the country with no well considered legislation and no ample means of enforcement as a rule, it has been only too apparent to any intelligent owner of an industrial plant that if he went to considerable expense to treat his wastes before they were discharged into whatever waters were nearest at hand, he would be handicapped by the fact that most, if not practically all, of his competitors were not even being seriously asked to assume a like burden of treatment.

Here, perhaps, is the greatest of the problems to be solved before material progress can be made in industrial wastes control. Fortunately, there is much encouragement of late in the growing willingness of manufacturers to co-operate with state authorities for the protection of our natural waters, provided only the authorities are reasonable in their requests.

The foregoing and many other considerations pertinent to this matter were either specifically or inferentially brought out at the stream pollution conference held at Philadelphia last week and reported in this issue. Much was also learned along these lines during the meeting of the American Public Health Association in Boston two weeks ago, when the sanitary engineering section of that organization devoted an afternoon to visiting industrial plants on the Neponset River, where two paper mills and a combined tannery and wool storing plant are each operating works for the treatment of their wastes that are on a par for complexity of the problems presented, the means used, and technical supervision exercised with almost any municipal sewage treatment plant in existence. This is in Massachusetts, and the results achieved there are attributed very largely to the reasonableness with which that state has proceeded in acting upon legislation passed years ago which on its face provided for very drastic action against these manufacturers.

One of the most hopeful indications of progress in sane measures of state control is reported by the action taken in Pennsylvania the present year. There the State Sanitary Water Board, created this year, is bringing together and co-ordinating the efforts of various state agencies having powers and duties in the field of the prevention of water pollution by industrial waste. Following and endorsing the later sane practice of the State Department of Health—as contrasted with the earlier idealistic attempts to stop all sorts of municipal sewage pollution at once—the streams of Pennsylvania have been divided into three classes and means for their protection against pollution both by municipal sewage and by industrial waste will be carried on accordingly. It is recognized that sewage disposal by dilution is legitimate; that some of the streams of the state are, for the present at least, so much given over

to sewage disposal that little can be done to reclaim them; that other streams are in a middle class and may be so treated; and that still others are but slightly polluted and should be carefully guarded—but all in accordance with the rule of reason, as to the expenditure of money, the burden that will thus be placed upon industrial and upon municipal treasuries, and the good of one sort or another that may be achieved by limiting or preventing pollution.

The protection of streams against pollution by industrial waste is a most promising field for work on the part of the engineer who can be both progressive and reasonably conservative, and who always bears in mind the value of the results that can be achieved from the measures which he proposes as compared with returns that could be gained for the same expenditures for another beneficial purpose.

What Is the Matter with Reclamation?

FOR twenty-one years the government has been at work reclaiming the arid public lands of the West. In that time hundreds of structures have been built and thousands of miles of canals have been dug so that eventually new homes might grow on land up till then made useless by lack of rain. It has been an enormous enterprise, costing millions today in order that future generations may benefit, and engaging the services of a fair proportion of our Western engineers. Yet during all this time the great body of the engineering profession—not being engaged in reclamation—has known of the work only casually. It has, to be sure, read with interest and pride of the large and excellent engineering structures which the government engineers have built. It has learned many things in hydraulic practice which it has applied to works other than those of irrigation. It has believed that the irrigation of government lands is an engineering problem, which is being solved with a fair degree of satisfaction by engineers.

The time has now come when engineers generally must take a more active interest in government reclamation. During all these two decades there has been another side to the problem—a political and a speculative side which culminated in the action of the present Secretary of the Interior in the removal of Arthur P. Davis as director of the United States Reclamation Service last July. The engineers engaged in irrigation have been long acquainted with this sinister aspect of reclamation. The engineers of the whole Western slope, in fact, know about it; but taken by and large the engineers of the country have not appreciated it. They have not known of the efforts underground and above ground which have been made to get Congress and the Department of the Interior to repudiate the law on which the reclamation of our public lands is based. They have not known the degree to which the land shark has robbed the settler of his heritage. They do not know the insistent political pressure that has been constantly brought to increase the profit of early holders at the expense of the rest of the country and of the future property owners on the reclaimed land.

All of this sinister influence came to a head last July, when Dr. Work sought to take control of the Service from the hands of the engineers and put it in the hands of the politicians. This act aroused the engineers of the country. It became evident that it was necessary that engineers everywhere should know about the operations of a service with which their fellow engineers were so intimately connected and the fortunes of which are tied up not only with the fortunes of the engineering profession but with the integrity of the government service and the proper development of the country as a whole. To inform the engineers of the country of the true inwardness of federal reclamation is the main purpose of the series of articles which start in this issue. The series is not partisan; it is not political. It is an honest effort to present to the engineers of the United States and through them to the rest of the thinking people of the United States an impartial picture of the reclamation of our federal arid lands. The future of the country depends upon the judicious development of its resources, and no resource is more important than the farm homes of the next generation. If the development of those homes is to be restricted by malign political influence, the people should learn about it in time to stop such an influence. The very evident demoralization of the Reclamation Service which has already set in from Dr. Work's performance of last July and the stimulus given to those who have long attacked the sound management of reclamation make it all the more urgent that Congress should act, and act soon, to assure security of the present development and to lay down a sound future policy for the more difficult problems ahead.

It is now the time to review the practical workings of the early policies of administration and it is to the engineers of the country that the rest of the country must look for an interpretation of the history of that work. It is certain that the enterprise has been vital to the West; that it has been efficient in plan and construction and operation. It is equally certain that it has not been perfect. The attention of the whole country should now be called to the defects of the law for the earliest revision, for the elimination of political control, and the broadening of the law to suit the coming needs of the West and elsewhere. In this the engineer can be of service. If every engineer, whether he has direct interest in irrigation or not, if he has only an interest in the proper development of his country and a justification of his profession, will read the articles which are to comprise the series and will act on the facts set forth in those articles, the engineering profession can do a great work in forwarding the reform necessary for the proper control of reclamation.

It is not the purpose here to describe methods or forecast results. We only urge upon every engineer reader the universality of the problems of reclamation. Let him read the story of its development and its application. Let him trace the story of the Reclamation Service from its Rooseveltian beginning to its latest demoralization. Let him realize how the science of irrigation, though reaching back to the beginnings of history, is still a new science with new facts and new troubles developing every year. Let him understand the degree to which the world-wide economic upheaval since 1914 has overthrown early dreams and theories in the irrigation country. And finally let him see how the thread of engineering control must run through all this if the fabric is to wear. Government reclamation of land is a great and continuing engineering problem. If this new series in *Engineering News-Record* can convince engineers of that—and through them Congress—we shall be content.

Federal Land Reclamation: A National Problem

1. Origin, Problems and Achievements of Federal Land Reclamation.

By F. H. NEWELL
Formerly Director, U. S. Reclamation Service

The First of a Series of Articles on the History and Performance of the Great Government Adventure in Irrigation of the Arid Lands of the West.

TO ALL engineers and in fact to all taxpayers and citizens, there is a peculiar interest in the life story of the U. S. Reclamation Service. The present time is appropriate for a review of its operations because of the fact that its history is now practically a closed chapter; the Service, as such, ceased to exist 21 years—almost to a day—after its creation. The work may continue as a bureau organization, but the feature which characterized the inception and development of its work has ceased to exist, namely, that this was an organization planned and officered by engineers, exemplifying the highest ideals of the engineering profession.

A review of the origin and development of the Reclamation Service is of importance at the present time not merely as a matter of history, but because citizens and taxpayers in various portions of the country are urging their representatives in Congress to adopt a broad national policy of land reclamation and settlement. This will involve expenditures of millions of dollars, not merely of federal funds, but of corporate and private moneys, in the creation of opportunities for more rural homes. A wise expenditure of these vast sums, which must be made as demands arise for more land, is dependent largely upon a full and correct knowledge of what has already been accomplished and particularly of the errors which should be avoided and of the mistakes which are inseparable with undertakings of this character unless careful study is given to similar undertakings. Public opinion must be guided not merely by sentiment or good intention, but by the hard facts of experience such as the engineer with his exact training alone can develop. While the engineer must necessarily be a man of vision, yet at no time can he afford to be visionary. "Without vision the people perish," without the dreams of the engineers, modern civilization would be impossible.

How Federal Reclamation Began

Taking it as a whole, the Service is an illustration that dreams sometimes come true. It accomplished in its life of twenty-one years larger results than had been seen by the dreamers, the men of vision, who looked forward to great accomplishment. The works which have been completed exceed in magnitude those which were anticipated, and the results in agricultural productivity far surpass the estimates made by its best friends. But the object of the advocates of the original reclamation act was to "make men, not money," and to do this through creating opportunities for small self-supporting farm homes on the vast area of vacant public lands. From such homes have come the leading men of our nation. The results achieved are therefore to be measured in true home-making, not in money profits.

Much of the vacant public land in the West had already passed out of the control of Congress when the reclamation act was passed in 1902, but many millions of acres remained, as shown in Fig. 1, including areas of fertile soil which might be cultivated, if only some natural obstacles could be removed, principally, the lack of water. Private capital had already been utilized in bringing water to ten million acres of these lands; all of the easily available localities where water might be had or applied to public lands had been taken up under one or another of the public land laws. But it was found that the large irrigation works needed for other

FIG. 1—VACANT PUBLIC LAND IN THE WEST IN 1902
When reclamation started there was much vacant public land available. Contrast the blackness of this map with that of Fig. 2, opposite.

of these lands were beyond the reach of individual or corporate efforts, largely because the cost of reclamation was too great to yield a profit on the investment.

In 1888, the Congress of the United States had been persuaded by Major John Wesley Powell, the explorer of the Grand Canyon of the Colorado, at that time Director of the U. S. Geological Survey, to make an appropriation to ascertain the extent to which the arid region might be reclaimed and utilized in the making of homes for citizens. In his topographic mapping and geologic studies of the West, Major Powell had become impressed not only with the mineral wealth of the region, but, more than this, with the opportunities for homemaking in the fertile valleys. He had published in 1879 under the auspices of the Smithsonian Institution his classic statement on "The Lands of the Arid Region." Subsequently he had left no stone unturned to bring the mineral and especially the agricultural importance of the West to the knowledge of scientific men and of Congress.

The surveys and examinations begun in 1888 attracted wide attention and, when added to the results of the data accumulated by the census of 1890, showed a condition of affairs which demanded public consideration. These facts indicated that further development of the arid lands might be indefinitely delayed unless the Government, the owner of the vast extent of public lands, made some effort to reclaim these lands. The data showed that practically all of the plow lands, such as had been available on the great plains and had furnished homes for millions of citizens, had passed into private ownership, largely speculative. If population was to increase, or even to hold its own in the vast arid states of the West, it would be necessary to make some radical departure and to remove the obstacles which were preventing additional homemaking.

Although the public began to awaken to the necessity of taking some action looking toward the better use of the public lands, there set in a counter current

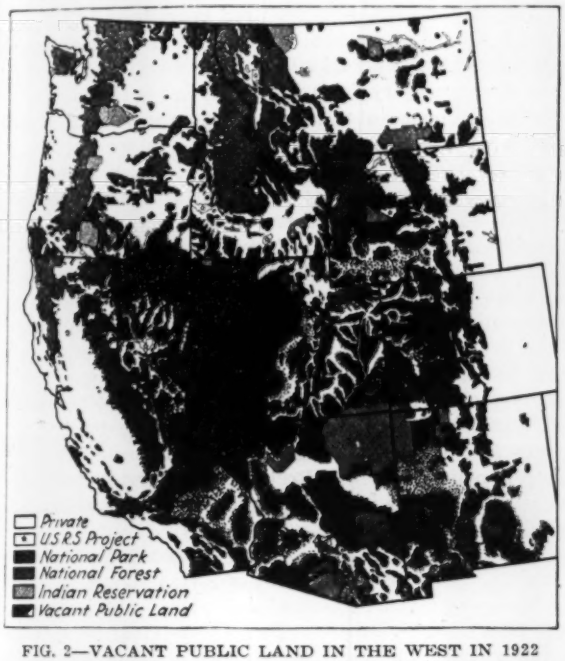


FIG. 2—VACANT PUBLIC LAND IN THE WEST IN 1922
Twenty years later the public lands of the West were practically all used up or reserved for park or forest.

against governmental action largely due to the fear, on the part of large land owners in the West, that the federal government would interfere with their systematic efforts in adding to their great acquisitions. Congress became stampeded for the moment and withdrew for a season further appropriations for investigation, stopping by act of Aug. 30, 1890, the setting aside of public lands which might be reclaimed and later, by act of March 3, 1891, restricting the reservoir sites and other lands needed for carrying out any plan of federal reclamation, specifying that such sites "shall contain only so much land as is actually necessary for the construction and maintenance of reservoirs, excluding as far as practicable lands occupied by actual settlers at the date of the location of the reservoirs." Demand for this arose from the fact that it was found that most of the best natural sites in the West had already been occupied in part as cattle or sheep ranches. The owners of these ranches in many instances had not taken the precaution of fully complying with the Land Office rules and regulations and thus the withdrawal of these publicly owned lands for purposes of reclamation interfered sadly with their plans of expansion.

In repealing, by act of Aug. 30, 1890, the permission to withdraw land for reclamation, Congress, however, provided that the "reservoir sites heretofore located or selected shall remain reserved." At the same time it, perhaps inadvertently, took a forward step, the importance of which was hardly recognized at the time. It provided "that in all patents for lands hereafter taken up," "there is reserved from the lands described a right of way thereon for ditches or canals constructed by the authority of the United States." At that time there was no authority for the government building such canals and the opponents of federal reclamation, that is, the large sheep and cattle men, were caught unawares. Thus, although the opportunities for future reclamation were greatly restricted, yet when the time came, ten years later, that the reclamation act was passed, it was possible to obtain necessary rights of way across public and privately owned lands under conditions far more reasonable than would have been possible had not this right of way been retained by the acts above noted.

In 1891 was held in Salt Lake City the first of a series of irrigation congresses. These were continued in successive years, with the result that public opinion gradually crystallized into a demand for action by Congress leading to federal recognition of the subject of land reclamation and settlement. The most active worker in Congress was Representative, later Senator, Francis G. Newlands of Nevada. He introduced bill after bill, but little consideration was given to the matter because of the usual objection by Congress to an increase of appropriations. Finally, the ingenious idea was wrought out, not of asking for a direct money appropriation, but achieving the desired results, without stating the quantity of money involved, by simply setting aside the proceeds from the disposal of public lands. These receipts had been shrinking rapidly, and, at the time the Newlands bill was under consideration, it looked as though the annual return to the Treasury would be less than a million dollars and would rapidly reach the vanishing point. Therefore, the prime objection to a reclamation policy was removed, as it was assumed that the amount actually available for such work would be quite small, and in any event would come from the states interested, and not through a direct tax levied upon the people of the whole country.

But even though the financial obstacle was removed, there did not appear to be enough general interest in the Newlands bill to secure action. The administration was indifferent and the leaders of both political parties were personally opposed to any such measure. It was not until the tragedy which brought Roosevelt to the presidency that the indifference was removed. One of the first acts of the new President, within a few days after being suddenly called to Washington, was to take up in private conference the whole subject of conservation, of forestry, and of reclamation. This he describes at length in chapter XI of his autobiography. As there described, he included in his first message to Congress his endorsement of the irrigation of the arid public lands. With this powerful advocacy, there was little delay, and on June 17, 1902 (Bunker Hill day), Roosevelt signed the reclamation act, making available the proceeds from disposal of public lands for the survey,

examination, construction, and operation and maintenance, of irrigation works in the sixteen arid states.

The then Secretary of the Interior, Ethan Allen Hitchcock, of St. Louis, Mo., upon passage of the Reclamation Act in 1902, having had no experience and with little interest in the matter, promptly referred the whole subject to Charles D. Walcott, the Director of the U. S. Geological Survey. He was the successor of Major Powell, who had been entrusted by Congress with the topographic and hydrographic surveys of the arid regions. Walcott in turn designated as chief engineer, F. H. Newell, who since 1888 had been studying the extent to which the arid region might be reclaimed and who had become the chief hydrographer of the Survey. The Reclamation Service was accordingly organized without specific authority of law, but as an instrument in carrying out the object of the reclamation act. It was not a part of the Geological Survey, but operated in co-operation with it, as the instrumentality through which the Secretary of the Interior carried out the intent of the law.

Basic Policies of Federal Reclamation

At the time the Reclamation Act was signed—twenty-one years ago—conditions were far different than they are today; the ideas then prevalent are now seen to have been not only vague but not based upon full knowledge by Congress of the available facts. The law was purposely made quite general in character; it gave broad authority to the Secretary of the Interior to execute the work, but did not indicate how it should be done nor did it provide any specific agency. The assumption was made that the secretary would have the necessary work planned by some of his employees, and then let a contract for a specified piece of work; later he would collect from the landowners, benefited by these works, the estimated cost of construction in ten annual instalments without interest. There is probably no law as far-reaching in its consequences as this in which such large discretion has been imposed upon one official. This discretionary power was its strength and also its weakness. It allowed the work to be adapted to the conditions found to exist and yet at the same time it left to the personal judgment of each of a frequently changing series of incumbents the larger policies on which success was based.

The policies fixed in the act pertained largely to methods of initiation of the work and to withdrawal of lands, a matter which had been the subject of much controversy, as before indicated, because of the reluctance of western men to permit the United States to exercise a control over public lands used by them for cattle and sheep grazing. This they regarded as an interference with their inherent rights to occupy lands belonging to the public. Emphasis was placed also by law on the limitation of the acreage of reclaimed lands which might be taken or entered by any one citizen. It was provided that the limit of area per entry "shall represent the acreage which, in the opinion of the Secretary, may be reasonably required for the support of a family upon the lands in question." The law also provides that the charges which shall be made per acre upon the entries or reclaimed land "shall be determined with a view of returning to the Reclamation Fund the estimated cost of construction of the project, and shall be apportioned equitably." As a matter of fact the word "equitably" has been applied practically as being synonymous with "equally," as it has been found impracticable to attempt to discriminate between adjacent farms or areas reclaimed by the same system, or to set terms which take into consideration differences of soil or location with respect to roads and centers of population.

The law also attempted to prevent non-resident ownership and provides that no right to the use of water "shall be sold to any land owner unless he be an actual bona fide resident on said land, or occupant thereof residing in the neighborhood of said land." Here, as in the case of the limit of entry, practice has developed most ingenious evasions of the object of the act, residence in the neighborhood being construed to include locations within 50 miles of the land, a single family or group of relatives occasionally holding several farm units, these being held in the name of the man, of his wife, of each son, and each daughter, of a brother, and so on.

The original law also required repayment in ten annual instalments, without interest, of the cost of water and provided for actual cultivation as well as residence.

It was necessary from time to time for the Secretary of the Interior to put into effect various principles which were not explicitly stated in the act but which could be inferred from its general object. It was fortunate that at the time of initiation of the reclamation work the men in direct charge had a large vision of the possibilities and a keen interest in the success of the law. President Roosevelt gave personal consideration to some of the larger principles and their application, being directly advised in this by Charles D. Walcott, the Director of the U. S. Geological Survey, with which the Reclamation Service was affiliated. In particular, the Secretary of the Interior from 1907 to 1909, James R. Garfield, brought to the law highly constructive efforts and ideals. In fact, it may be said that the larger policies of the Reclamation Service were developed under the immediate and personal consideration of Garfield.

At that time there was little or no urge that the smaller canals or distributing systems should be built by the government; practically all plans were made with the idea of carrying into effect the original conception, namely, that the government should build the reservoirs and main line canals and that the settlers, following the example of the older pioneers, should organize and build the small works themselves. Garfield devised and carried out an ingenious system by which this was being done. Unfortunately, his successor did not view the work in the same light and abolished the Garfield method, throwing upon the government enormous expenditures with the accompanying difficulties of building all of the minor works, even down to the fields of the farmers. To the abandonment of this principle of requiring the local land owners to help themselves as far as possible may be attributed many of the subsequent difficulties.

At that time there was no thought that the government would be called upon to go into all of these minor matters or be urged to actually level the small individual holdings and put these in condition for crop production. Congress and the people in general did not see the necessity for going beyond the original conception of the government building the larger works such as were beyond the ability of the pioneers. Thus no provision was made then for meeting the subsequent insist-

ent and rapidly growing demand for more and more work to be done at federal cost.

Complicating Conditions

Throughout the entire West there is more good land than there is water available for its reclamation. The choice, therefore, of areas to be reclaimed was limited not so much by the character of the land as by the location of the water. This fact had been brought out by the earlier surveys, but the people of the West in general had little conception of the limitations which existed as regards water supply.

Appropriation—To understand the conditions which confronted the Reclamation Service on the initiation of its work, it must be had clearly in mind that in the arid region the laws regarding the water are in one sense the reverse of the common law of England and that of the Eastern or humid states, where the so-called riparian laws prevail. These latter require that under ordinary conditions the waters of the streams shall be allowed to flow in their natural courses unchanged as to quantity or quality. In the arid region, the common need of the people, which ultimately assumes the force of common law, is that, if necessary, all of the water of a stream shall be taken out upon the dry lands. The water which ultimately returns to the stream through seepage, becomes greatly changed in quality since it receives the earthy salts or alkali washed out of the soil.

While in most of the Western states, legislation or court decisions established the doctrine of appropriation, in some states, as in California, the water laws were in a nebulous condition. In these states, the laws and decisions in some cases appeared to uphold riparian rights, in others, to limit or deny them, causing much uncertainty and delay in development.

Legal Limitations—The obstacles interposed by nature were less difficult and annoying than those just noted, of purely human origin, arising from neglect or abuse of the water laws. The Western representatives, aware of this condition and at the same time jealous of local rights and fearful that in some way these might jeopardize by federal interference, insisted upon the insertion in the reclamation act of a provision to the effect that all work executed under the terms of the reclamation act should be in conformity with state laws relating to water control. A few of the states, notably Wyoming, provided machinery and methods for ascertaining the amount of water in the various streams and the claims which were made to this water. In other states, however, the custom had grown up of each man's claiming everything in sight so that the aggregate of the claims often far exceeded the amount of water in the stream, and yet only a small part was actually being used.

It should be kept in mind that practically all of the best lands which might be available for reclamation had by 1902 already passed into the hands of individuals and from these had gone under corporate control. During the long years in which discussion dragged as to the possibility of Congress adopting a policy of reclamation, the enterprising citizens and the speculators, as well as the land and cattle companies, through their employees or friends, were extremely active in filing upon every acre of public land which might be developed and upon the waters in every stream throughout the arid region. This activity in acquiring reclaimable land was facilitated by the congressional acts of 1890 and 1891 above referred to, which prohibited public officials from withdrawing public lands excepting those actually needed for reservoirs.

Thus, when the time arrived that funds for reclamation were actually available, there were found to be many recently created obstacles. Some of the projects which would otherwise have been relatively simple and inexpensive of achievement, had necessarily to be passed over on account of these recently acquired rights in lands and waters; other more difficult projects had to be taken up—all of these having notable obstacles from the engineering standpoint. It is fortunate that at that time, during the initiation of the large works which have been carried on during the past twenty years, there was left in the hands of the Secretary of the Interior a large discretion which enabled the overcoming of some of these difficulties. Had it been necessary then, as it is now, to go to Congress for the solution of many of these details, it is easy to imagine that much of the work would not yet be started.

In shaping the original act, it was assumed that most of the land to be reclaimed was in public ownership and that this land would be entered upon after reclamation under the terms of the homestead act. In fact, the extension of the benefits of federal reclamation to the land in private ownership was of the nature of an afterthought on the part of the committee which had the matter in charge. Congress was with difficulty persuaded that the condition above described actually existed. As was ultimately shown, the privately owned land, reclaimed by public funds, has far exceeded in area and value the lands which were public at the time of the passage of the reclamation act and which have been opened to homestead entry under the terms of the act. The point has been frequently made that there can be little real difference as regards treatment between the land which was entered yesterday before reclamation and that which may be entered tomorrow after plans for reclamation have been adopted.

The first, the crucial, test of this principle came about immediately after the passage of the reclamation act in the case of the arid lands in the Salt River Valley in Arizona, near Phoenix, the capital city. Here were at least 200,000 acres of land which had already passed out of public ownership and on which some improvements had been made and lands cultivated in part with the inadequate water supply. Around these were a million acres of equally good land in public ownership open to homestead entry. The question was raised as to whether the water to be stored by expenditure of federal funds should be sold to the lands already in private ownership and then partly developed or be held for other adjacent lands to be taken up under the homestead act. If the latter course had been pursued, thousands of small land owners would have lost the value of the improvements already made; they would have been compelled to move and to re-establish their farms on other lands no better but for which the new water supply was provided. The decision was wisely reached that as between these alternatives the preference should be given to the land in the hands of small owners who had already spent all of their available means in attempting to make a home.

The situation was further complicated by the fact that in many localities there has been a conflict between the demands for water for irrigation and for development of hydro-electric power. Theoretically, the rights

to the use of the water should be based on a priority not strictly of time but to a large extent of use. In theory, preference should be given, first, to the needs for domestic and municipal supply, next to the production of food through irrigation, then to power and, last, to navigation. Where, however, power plants had already been established on the streams, particularly below points where water might be diverted for irrigation, it has been practically impossible to develop the irrigation projects without interfering with the vested rights of the owners of the power plants. Such conditions were found to exist, preventing the taking up of several enterprises. Where, however, the power developments were above the points of diversion for irrigation, then the difficulties were not so great. These

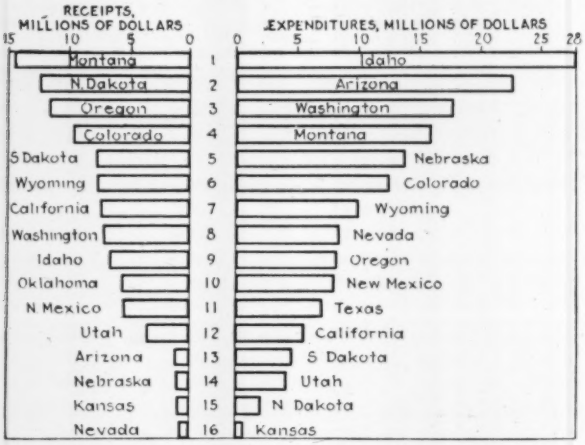


FIG. 3—RECLAMATION FUND, RECEIPTS AND EXPENDITURES BY STATES FOR 20 YEARS

obstacles, growing out of the acquisition of rights for power, are steadily adding to the complication of development of reclamation works.

Apportionment by States—The reclamation law, as originally passed, provided that where practicable the major portion of the funds arising from the sales of public lands in each state should be expended in that state. This clause was inserted as a concession to certain sectional influences. After a few years of practical operation, it was found that this provision of law had the effect of compelling the consideration of less meritorious projects in the states from which large funds were derived and that better projects in other states were being given less consideration. In fact, the need of reclamation was found to be in inverse proportion to the amount of money coming from a state. For example, the state having the largest area of public land, Nevada, has a climate so arid, with such small water supply, that the public lands cannot be sold, and yet at the same time the needs of reclamation are perhaps greater there than in other states where the lands were being rapidly disposed of. Although this provision was repealed on June 25, 1910, yet even now there continues to be a demand for construction in proportion to receipts from each state.

The present condition as regards receipts and approximate expenditures by states is given in Fig. 3, which indicates that the largest amount of money has come from Montana, while the largest amount of expenditure has been in Idaho, where about four times the amount of money received has been utilized in reclamation works. There is really no good reason why the money derived from disposal of public lands in any one state or group of states should be dedicated to home-making in any other restricted area. That is to say, there is no inherent right for Idaho, for example, to claim that the receipts from public lands in North or South Dakota, Oklahoma, or other states are, by any moral or ethical consideration, dedicated to use in Idaho rather than for use in Mississippi or Louisiana, from which states the proceeds of public lands have gone directly into the federal treasury. Nevertheless, there has been a strong sentiment that the West is a separate entity and that the public funds derived, for example, from Oklahoma, should be used in the reclamation of some area to the West rather than to the improvement of a body of land to the East in Arkansas or Louisiana.

The passage of the reclamation act, and the works proposed under it, had a stimulating effect on state legislatures in inducing them to provide adequate methods of adjudicating the quantity of water available. It was plainly evident that federal funds could not be used in reclamation until there was some assurance that the water stored or developed by the use of these funds could be made available permanently for the lands to which the irrigating canals were built.

In some cases, enterprises otherwise desirable were passed over because there was reasonable doubt as to whether other claimants might not be able to establish a prior right to the waters needed for the government works. Thus considerable time was lost and a large amount of energy expended in development of these matters which should have been given earlier attention by the state legislatures.

In the years immediately following the passage of the reclamation act, there was somewhat general indifference as regards the place of expenditure. The popular imagination had hardly awakened to the possibilities of reclamation in building up industries and land values. In fact, in several of the states such as California it was quite difficult to get the state officials and public bodies to co-operate in securing necessary rights and privileges such as would facilitate the expenditure of federal funds. This fact seems now almost inconceivable and yet throughout that great state, although many projects were examined, it was found necessary largely because of this indifference, to select a project on the extreme north of the border of Oregon and another in the extreme south on the border of Mexico. Every other intermediate project was in the hands of investors or was tied up in such way that federal reclamation was not then practicable.

This condition of relative indifference was afterwards appreciated to be highly beneficial as a whole because it delayed the growth of political pressure and the throwing of the reclamation fund back under the direct control of Congress, putting it, like the river and harbor appropriation, into what has been termed "the pork barrel." While this is hardly an appropriate characterization, yet even the greatest optimist is forced to admit that the local politicians, who were indifferent during the early years of the Reclamation Service, later became extremely active in urging their pet projects, even threatening the official life of the men who opposed them. On the whole, however, it may be said that there has been a minimum of politics mixed with the work of the Service. No human institution can be said to

be entirely free, but the older projects of the Reclamation Service are notable in this regard perhaps largely because of the condition before noted, namely, that the politicians had not discovered the opportunities!

Thus, although the original projects were permitted to develop almost entirely upon their physical and economic merits, yet at all times it was necessary to make adjustments and to undertake enterprises which did not turn out well. For example, the law required originally that some work be undertaken in Kansas; the best opportunity from the physical and economic standpoint was chosen and yet this did not succeed largely because the climate was not sufficiently arid. Experience has shown that the land owners will not practice irrigation habitually unless forced to do so by constantly recurring seasons of drought. An occasional wet year practically destroys the value of permanent irrigation work. These enterprises which had to be taken up because of legal requirements and which did not succeed economically in the aggregate, however, form a very small proportion of the total expenditures, so that the claim may be properly made that the percentage of failures due to all causes has been as small and possibly less than that of any large corporate undertaking. Judging from the biographies of great captains of industry—Hill, Harriman, Morgan, and others, the percentage of success attained by them in their investments is, to say the least, no greater than that of the investment of the reclamation fund.

Planning and Construction

Beginning with a few projects, which had already been examined by the Hydrographic Branch of the Geological Survey, step by step the work was entered upon in each of the reclamation states. Contracts were let and an organization was built up for doing those things which could not well be covered by the usual form of contract. It was found, for example, that the awarding of contracts for deep foundations for dams in relatively inaccessible places or for digging of tunnels under conditions which could not well be determined in advance, resulted in many failures and in protracted lawsuits. Better results could be obtained if the risks of such enterprises were assumed by the government directly rather than left to competitive bidding, especially where contracts under the law must be awarded to the lowest bidders, many of whom were then unskilled in this particular type of work. The best results were obtained where the government forces and the contractors were practically on a parity, in that the results of one method could be checked up against that of the other. The highest degree of economy and efficiency was secured through the competitive spirit thus developed.

Because of this relative freedom of organization and of method it was possible to build up in the Reclamation Service a morale or an *esprit de corps* such as has been rarely attained in government service. Every engineer, technician, or clerical employee, who has been connected with the Service, looks back with pride on those days when the organization was pushing ahead, carrying on its great work not only with a high degree of precision, but, more than this, with the feeling of mutual respect and confidence due to the free expression of minds unhampered by outside control.

The organization of the Reclamation Service kept pace with the selection of new projects and the letting of contracts or beginning of work on these. In this selection consideration had first to be given, as before noted, to state lines because one of the requirements of law was that at least one project should be located in each state; hence the entering upon the Garden City project in Kansas, the Williston Pumping project in North Dakota, and a few others. Next to this was consideration of the existence of public lands. And here, as before stated, was encountered one of the first obstacles. For example, in Nevada the irrigable public land alternated with sections of land granted to the Central Pacific Railroad. Public exasperation against the railroad was such that the government was not justified in attempting to reclaim these public lands within the limits of the railroad land grant; moreover the railroad officials at that time were not inclined to make these lands available for reclamation and settlement, excepting under terms which were practically prohibitory. In this case, therefore, it was necessary to go outside of the railroad land grant limits and take lands which in some ways were less favorably situated.

Careful consideration was given to soil conditions, the probable extension of railroads, and possibly crops and markets. At that time the study of the soils was relatively in its infancy and while the soils were classified, yet few men dared to venture an opinion as to what kind of crops might be successfully grown after the lands had been irrigated a few years. They were wise in this position, because the outcome of twenty years' experience has shown that much of the soil then considered of the very best quality has become hard or impermeable to water, and other soils regarded as doubtful, have been transformed and are now productive. These changes are discussed by Carl S. Scofield in a succeeding article, but emphasis should be placed upon the fact that even today, with all the experience had, a man will be rash indeed who will attempt to select irrigable land on the basis of the ordinary soil survey and to predict what changes will occur during the next ten years.

This selection of land was of course controlled by the policy to obtain water and bring it by gravity to the highest point of each possible farm. Here the topography controlled, and while selection was made where practicable according to considerations of soil as well as climate, transportation and markets, yet the choice was necessarily narrowed down to the relatively few places where water could be had.

Moreover, the questions were not those simply of getting water but more than this of providing a quantity adequate for dry seasons and yet at the same time not restricting the area of land so greatly that the cost per acre would be excessive. In nearly all of the projects entered upon by the Reclamation Service some storage had to be provided. This is because of the fact that when the law was passed, all of the easily available sources of water had been filed upon and put to partial use leaving to the government only the excess water which came in irregular floods.

The problem of flood storage has been not merely that of holding enough water for the next year but of anticipating the probable demands for several successive years of drought. While it might be practicable to irrigate alfalfa for example, during a year of ample water supply, and then let the fields go without water during the next dry year, such course of procedure would be ruinous to orchards and to well planned sys-

tems of rotation. The providing of storage, therefore, is by no means a simple mechanical process but one involving careful judgment based upon long continued studies of the erratic water supply.

The one feature which characterizes work under the reclamation act, differentiating it from most of the private enterprises which had preceded it, was the relative permanence of all structures, especially of

FIG. 4—LOCATION OF GOVERNMENT IRRIGATION PROJECTS

storage reservoirs, diversion dams, flumes, and similar works. In the case of private enterprise, the heavy interest charge on permanent investment on the money borrowed for construction necessitated keeping down this amount to the very minimum, thus utilizing wood for dams and flumes, even though it was known that these would decay within a few years. It was hoped that those wooden or temporary structures would hold together long enough to permit the investors to get their money back. In the case of government funds, however, bearing no interest charge, and devoted to works intended to last for centuries, the chief consideration was permanence, this being in the long run the highest economy.

The construction at the outset was as a rule by contract, but conditions forced the taking over of some of these contracts and completing them by daily labor. The experience thus acquired showed that the government engineers with ample funds available could really do the work at less cost, all things considered, than could the usual contractor who was compelled to buy equipment for each new piece of work and to borrow money often at ruinous rates. Thus grew up the so-called force account and construction accompanied by careful cost-keeping not only of the work done by the government but of that done by contractors so that at all times a comparison could be made of the relative economies of each system of work.

The engineers and all others connected with the work were carefully selected by intelligent application of civil service rules. During the first decade at least, or until the politicians discovered the service, it can be truthfully claimed that not a single appointment or promotion was made for other than ability and merit. Thus was developed a somewhat remarkable body of men and today one of the greatest satisfactions is to find that practically every man and woman who has been connected with the Reclamation Service speaks of this connection with pride.

Out of this condition has grown perhaps a most remarkable series of engineering successes. It is true that, looking back, it would now be possible to improve some of the plans, but this can be done only because of the results developed in these earlier works. Many attacks have been made upon the Reclamation Service and for years congressional investigation committees took up one phase or another. At one time a body of army engineers was appointed by President Taft to make a study. Their report was highly gratifying and it is probable that no man in the Service would or could have written a more commendatory statement than that given in the cold language of an official report.

Work Done

Briefly enumerated, the total amount of work achieved may be summed up in the following statement: that on 26 projects located as shown in Fig. 4, water can be served to 3,000,000 acres in round numbers, including from these projects, 1,700,000 acres for which the government systems furnish the sole supply for irrigation. Of this latter, 1,200,000 are actually harvested. The total number of irrigated farms is 33,000 and the population of these farms, 125,000. The gross annual crop is valued at $50,000,000. The increase in value of lands and other properties on farms and in towns, within the projects is estimated at $550,000,000. The works as now constructed included 100 storage and diversion dams, reservoirs with a capacity of 10,000,000 acre-feet or storage, 4,000 miles of main line canals, and 8,000 miles of laterals or distributaries, 28 miles of tunnels, 140 miles of flumes, 9,100 bridges, and thousands of smaller structures.

Looking back over a stretch of twenty years of intimate connection with the engineering, technical, and administrative details of the Reclamation Service, there stand out amid the host of recollections certain impressive pictures. During this time over $140,000,000 of federal funds have been invested in building large works of reclamation, some of them monumental in character, all designed, however, with the ultimate object of providing opportunities for small self-supporting farm homes. The results attained in number of homes and in crop produced have exceeded the expectations of the advocates of the reclamation law. At the same time, however, there have been disappointments and failures, such as are inseparably connected with any human enterprise.

From the purely engineering standpoint, there have been notable advances in methods and efficiency of construction. These have kept pace with the development of similar work elsewhere, since the operations under governmental control have been checked up continually against those handled by corporations or individuals. There has been a continual interchange of ideas, the government works have been visited at short intervals by engineers and experts from all parts of

the world, incidentally contributing information or advice, as well as receiving inspiration for inaugurating similar works in other countris, and in other parts of the United States.

The files of *Engineering News-Record* contain full descriptions of most of the notable works and of methods employed in construction, so that at this time it is hardly necessary to comment upon these other than to refer to the fact that these works have served to a certain extent as a training school for many of the engineers of the present generation and to a certain degree as a laboratory of research into details whose practical applications were needed in the completion of other undertakings.

With the completion of the works, however, it may be said that "the real trouble begins." Under the original conception of the act, it was assumed that as soon as the works were done the government in some way would step out and would be concerned merely with the collection of the cost. This, however, has not been the case. Instead of being able to step out, the government has become more and more entangled in petty personal details of peddling water to thousands of land owners. Among these land owners are good farmers on good lands having good results, and on the other extreme are inexperienced or poor farmers on poor land pursued by bad luck. In between are all gradations of ability, experience, strength, good health and good sense.

In general it may be said that the reclamation act in many ways is ideal, but to be successfully operated it must have ideal men and ideal communities such as do not yet exist. Most of the efforts of Congress since the passage of the reclamation act have been along the line of trying to patch it up to fit the needs of the inexperienced land owner, the "town farmer" or speculator. The ideal land owner and water user is not in the majority. Year by year efforts are being made here and there to lower the requirements of payment and to add more and more money to the fund to make up for the fact that payments are not promptly made. There is now quite a volume of law and decision so that it is rather difficult to gain a comprehension of the actual intent and operation of the law. Because of this, many citizens are urging that there be a rather complete revision of the law based on the experience of the past twenty years, strengthening the desirable portions and modifying other parts to meet conditions which have arisen. Moreover, the excellent results which have come from the passage of the reclamation act have attracted the attention of taxpayers in other parts of the country and they in turn are asking that the law be made broad enough to cover the reclamation and use of waste lands in every and all parts of the United States.

[*This is the first of a series of articles discussing the problems and progress of the Reclamation Service. The next article will appear next week.*—EDITOR.]

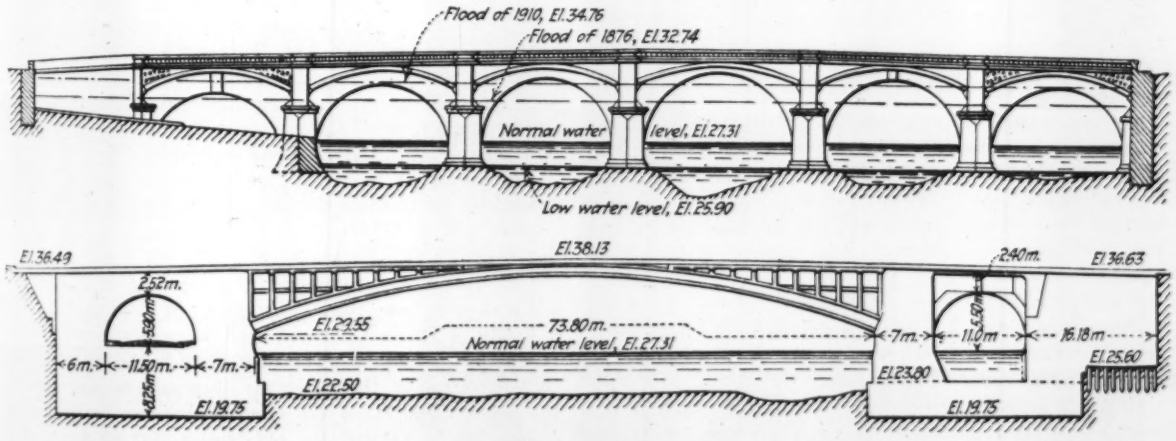
Rebuilding Tournelle Bridge as Flood Protection Measure in Seine River

FOLLOWING the extraordinary flood in the Seine which caused much damage to property in the region of Paris in 1910, important engineering works have been conceived to limit damage which might be caused by similar conditions. These projects have been of diverse nature, designed to be carried on as a comprehensive whole. For instance the program includes construction designed both to facilitate the passage of flood waters through the Paris district as well as to reduce the intensity of flood waters.

In the first group of improvements is found the repair of the shore works of the Island of Saint Louis and of the Tournelle bridge. The reconstruction of the Tournelle bridge is now being carried on. The bridge has been demolished and a new structure is to be erected as soon as certain legal obstacles to reconstruction have been disposed of.

The Tournelle bridge was one of the oldest in Paris, having been built in 1654. Like all structures of its era, it contained semi-circular arches of small opening, making navigation more or less difficult, particularly during high water. In addition, during floods, free passage of water was impossible because of the number of piers, and the spandrel walls formed a dam when the water rose above the crown of the arches. This was the case in 1910, the key of four of the six arches having been submerged. The new designe, says a recent issue of *Le Genie Civil*, contains a main reinforced-concrete arch 73.8 meters in span, resting on abutments 25 meters in length containing arches with opening of 11 meters and 11.50 meters, respectively.

The crown of the reconstructed arch is above the record water height of 1910. Passage of excessive flood waters is facilitated in another way by the new design which provides for the floor system to be carried on continuous columns spaced at 2½-meter intervals.



ELEVATION OF OLD TOURNELLE BRIDGE AND DESIGN FOR NEW BRIDGE

Damaged Earth Dam Repaired by Hydraulic Fill

Over 300,000 Cu.Yd. Pumped Into Embankment, Reduced by Settlement and Wave Action —Pump Fed by Drag Bucket

By M. E. Bunger
Engineer, Model Land & Irrigation Co., Trinidad, Colo.

A LESSON of faulty embankment construction is contained in the series of repairs to the earth dam of the Model Land & Irrigation Co., near Trinidad, Colo. Incidentally the work illustrates an interesting combination of equipment for making hydraulic fill.

The dam for the Model Reservoir is an earth structure 5,900 ft. long and 45 ft. high. It was built with a 1 on 1½ slope on the inside and a 1 on 2 slope on the outside and and 18-ft. roadway on top. Teams and dump wagons were used and the fill was not puddled and received only such rolling as would occur from hauling over it. An unexpected flood showed the fallacy of such construction; the water went right through the structure. For some unknown reason, however, the earth above the hole caved in and stopped the flow and only a small amount of damage was done. The dam was then puddled by pumping water into it through holes jetted down from the top.

The inlet ditch of 3,000 sec.-ft. capacity comes into the reservoir at the south extremity of the dam, and

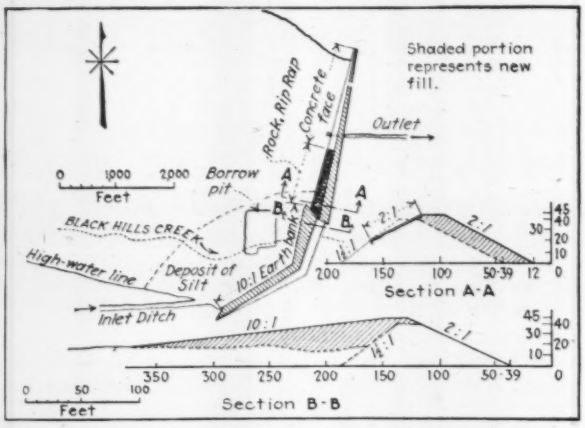


FIG. 1—PLAN AND SECTIONS SHOWING REPAIRS

as the outlet is near the north extremity the silt carried by the water was deposited along a greater portion of the inside face. This has been a great factor in sealing up the dam and making it safe for the storage of water.

On the inside the dam was faced with a 6-in. layer of concrete reinforced with hog wire fencing. The hog wire was placed longitudinally and the contractor was not careful to lap or fasten the wires. When the dam settled, lines of weakness developed at these points and the concrete face cracked. The waves, where these cracks occurred, would run up the concrete, enter the cracks and carry away the earth underneath. Concrete patches were put over the cracks but as no reinforcing was put in them, they would in turn crack and the earth was removed as before.

Several terrific wind-storms occurred during the month of May, 1920, while the reservoir was two-thirds full of water, with the result that the upper 19-ft. vertical elevation for a distance of 1,500 ft. in the center of the dam was completely destroyed. A partial failure also occurred on 2,500 ft. more of this facing on both sides of the center portion that failed. Where the concrete was not entirely destroyed the facing was repaired by placing over it a new layer, 4 in. thick, of 1:2:4 mix, reinforced with ½-in. square, twisted rods spaced 14 in. both ways. In the places where the old facing was destroyed the cavities were filled with earth and well puddled and a new layer of concrete 6 in. thick was placed over them. This repair work took care of 1,600 ft. of the facing.

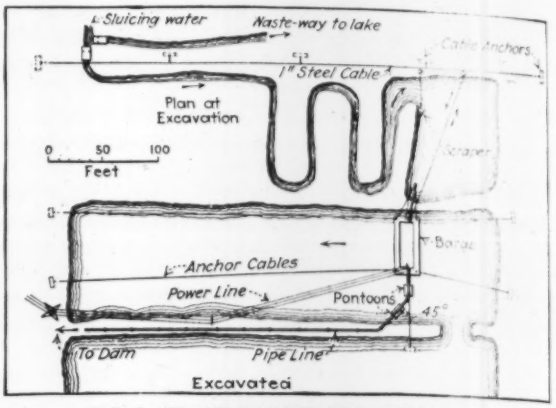


FIG. 2—PLANT LAYOUT FOR HYDRAULIC FILL OPERATIONS

On the next 1,500-ft. section where the concrete was entirely destroyed and over 2,000 cu.yd. of dam washed away, it was thought best to cut the face back to a 1 on 2 slope and face with riprap. It was thought that the riprap being rough would greatly decrease the wave action and would be more elastic than the concrete. The upper 19 ft. vertically of the dam for a distance of 1,500 ft. was then cut to a 1 on 2 slope and the earth used to build back the face. This earth was thoroughly puddled and packed. After this was done there was needed about 1,000 cu.yd. more to complete the face.

Hydraulic Fill Operation—The puddling of the dam and the manner in which it was built caused a settlement beginning with 0 at the north end and amounting to between 5 and 6 ft. in the center. It was necessary, in order to fill the reservoir to the capacity for which it was built, to build back this five or six feet. To increase the height and to maintain a roadway on top especially where the face was cut to a 1 on 2 slope, it was necessary to build up a layer of earth on the outside 27 ft. wide (Fig. 1). This work involved placing some 160,000 cu.yd. of earth, all of which if taken from without the reservoir would have to be hauled from the extreme ends of the dam as all suitable earth below had been used in building the dam originally.

Beginning at the south extremity of the dam and extending north for a distance of 2,800 ft., a large quantity of silt had been deposited, reaching a maximum depth of 20 ft. This silt extended out 1,000 ft. from the dam and was composed of layers of sand, gravel, silt and pure blue clay. The layers of clay varied from 2 in. to 4 ft. in thickness and were soft and boggy. It was figured that if a method could be found to utilize this material in the reservoir it would be cheaper on the south 2,900 ft. of the dam to place an embankment on the inside against the old facing and on top of the silt already deposited with a 1 on 10 slope on the in-

side, to resist wave action, than it would be to build up on the outside 27 ft. wide and repair the facing above the silt on the inside. It was decided to build a dredge in the lake and pump the material for the 1 on 10 slope on the inside for the south 2,900 ft. of the dam, and for the layer 27 ft. wide on the outside for the remaining portion and also to pump the material required to build back the face. The total volume to be moved was approximately 300,000 cu.yd. Pumping had the advantage of having the material thoroughly packed when it had settled and, where pumped on the outside, of forming a perfect bond between the old and new portions of the dam and puddling the old dam where it had not been puddled before; also the removal of the silt would increase the capacity of the reservoir.

A barge 24 x 50 ft. was built and equipped with a 10-in. centrifugal sand-pump, belt-driven by a 200-hp. motor; a 3-drum hoist driven by 25-hp. motor; a 2-in. priming pump driven by a 10-hp. motor; and other accessories necessary for the operation of the barge.

It was necessary to build 8 miles of standard transmission line for 22,000 volts, from one of the coal camps west of the reservoir. This current is transformed down to 2,300 volts and carried to the barge on insulated cables supported by movable towers 14 ft. high. The 200-hp. motor operates at 2,300 volts but transformers are placed on the barge stepping the current down to 210 volts for lights and the other motors. Twelve pontoons were built to carry the pipe line close to the barge. The pipe used consists of 300 ft. of 10-in. standard rolled steel pipe, 500 ft. of riveted steel pipe with flanges and 1,000 ft. of riveted steel pipe with slip joints.

After the dredge was in operation it was found that the material would not cave and readily slide toward the nozzle and that to run the pump to capacity some method of bringing material toward the nozzle was necessary. Sluicing with water by gravity was first tried. A hole was excavated 16 to 20 ft. deep with the large pump assisted by a high pressure jet from the small pump. Then a stream of water, about 15 sec.-ft., was turned into the hole. As long as this water was running through silt and sand it sluiced very readily but when a layer of clay was encountered cutting ceased and it became necessary to trench with shovels before the material began to sluice again. While this trench was being cut, the pump would be handling little or no solid materials and it was difficult to hold the clear water in the forms. Various scrapers were then tried that would cut through the blue clay rapidly and also drag it into the nozzle. A scraper was designed that would peel off a layer 2 or 3 in. thick of any material over which it would run, and was so designed that when it was loaded to capacity the cutting blade would automatically be lifted and the load pulled into the suction nozzle without further cutting. This scraper drags in from 1 to 6 cu.yd. at a trip depending on how the material caves in front of it.

It was found that some of the material would stand with a vertical face though the cut would be 20 ft. deep and the only way it would cave would be to undermine it. If the bottom layer happened to be sand this undermining could be done very readily with water, but if it happened to be clay, water had little effect on it. A modified road plow was bolted onto the side of the scraper in such a fashion that as the scraper was being drawn back empty the plow would turn out a furrow from under the cliff whether the material was clay or sand and generally after two or three trips with the plow the bank would cave.

The method of operation has been to lay out the silt in areas 100 ft. wide and 500 ft. long and construct a sluicing-ditch back and forth across this area (Fig. 2). The dredge was started at one side and moved as the material was excavated. The sluicing is done in a trench perpendicular to the direction of the scraper This gives a maximum fall for the water and allows the material caved by the scraper as well as that caved by sluicing to become thoroughly mixed with water before being brought to the nozzle (Fig. 3). As the scraper comes to the nozzle, the nozzle is lifted by the operator and the hole underneath is filled with the scraped material. Then while the scraper is going back after another load, the nozzle is worked up and down and gradually clears out the hole for the next scraperful. This method does not choke the line with mud and gives an even flow of solids. The sluice water runs toward the nozzle and is carrying solids continually. A dike is maintained between the barge and the end of the nozzle in order that clear water may be available for the small priming pump and also to confine water so that all sluiced material will settle where either scraper or sluiced water can reach it. A small dike is also

FIG. 3—SUCTION PIPE AND SUMP FOR SAND PUMP

maintained between the area being scraped and the one previously scraped out to confine the water within the area accessible to the scraper. This dike is removed when the dredge is ready to be moved to a new location. After one area 100 ft. x 500 ft. has been excavated the dredge is floated into the pit and a new land opened up.

Settlement of Pumped Material—Where the material is used to build up a layer 27 ft. wide on the outside of the dam a wooden form is used on the outside consisting of two 2 x 12-in. x 16-ft. boards bolted to two 2 x 4-in. x 2 ft. 6-in. long uprights spaced 4 ft. from the ends. These forms are lapped and held by three pipes which are old boiler flues cut in 5-ft. lengths. These pipes are driven into the ground a distance of 2 ft. No bracing is used on these pipes except at the lower end where a pool of water is held to aid in the settlement of the extremely fine particles. The tail water from the outside is run back into the reservoir

through a 24-in. tile placed through the north extremity of the dam when it was constructed. When the form is filled the pipes holding the forms are removed and the boards are placed on the filled portion 4 ft. from the edge. A little straw is placed where the board rests on the sand and an embankment is thrown against the form with a railroad wing plow pulled by horses. This prevents the water from cutting under the boards. This outside form is 2,700 ft. long and six men are employed to watch it to prevent leaks and to turn the current when it runs toward the form. About five days are required to pump the form full and two days more are required to change the forms and plow the embankment against them.

On the inside where the fill is made with a 1 on 10 slope no wooden forms are used but a dike is thrown up with the wing plow and only two men are employed to watch 2,500 ft. The water, when the material is pumped inside, after all the solids are settled out, gets back into the sluicing-ditch and is used again.

The delays so far have not been very serious or have not added greatly to the cost. The main causes of delays are breaks in the sluicing-ditch, breaks in the forms on the outside and the choking of the nozzle with lumps of coal and trash. When the nozzle is choked the sluicing water is cut down and the speed of the pump is reduced to the minimum and the nozzle is raised as high as permissible without losing the priming. The operator then gets down and removes the material caught on the screen either with his hands or

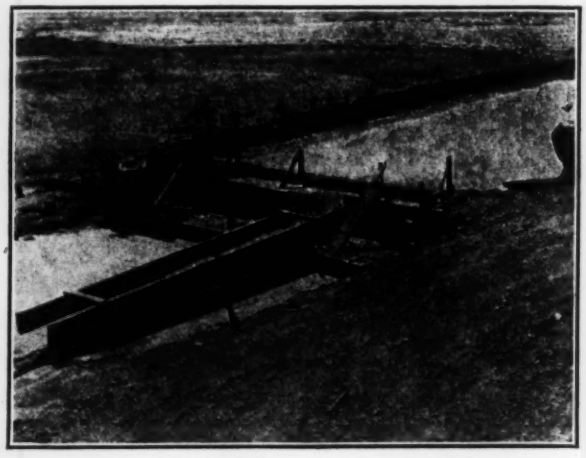


FIG. 4—WASTEWAY AT END OF FORM FOR DOWNSTREAM FILL

feet, sometimes using a bar. After it is clean, the nozzle is lowered and the pump speeded up The advantage of this method is that the priming is not lost.

A log of operations is kept and there is not lost during the 9-hour day over an average of ¾ hr.

The cost of the entire plant ready for operation was $41,084.91. The cost of labor, power, repairs and all other expense incidental to the moving of the earth has been $25,504.52, and the total yardage removed to date has been approximately 210,000 cu.yd. at a cost of 12.14c. per cubic yard. Figuring the cost of plant into the work, the total cost to date would be 25.83c. per yard.

The cost of reinforced concrete averaged $17.50 per yard and the cost of the rock riprap averaged $7.50 per cubic yard laid on the face.

Through the Reclamation Country

By F. E. Schmitt
Associate Editor, *Engineering News-Record*

A SERIES OF ARTICLES on Federal Land Reclamation starts in *Engineering News-Record* in this issue. It will give a history of the twenty-one years of government irrigation, state the many problems of operation—engineering, agricultural and financial—analyze the various complaints that are being so emphasized by those who are seeking a reform of the current law and methods and seek to present some views as to a constructive policy in the future. Through it all will run the evident theme that irrigation, from planning, through construction to operation, is a continuing engineering problem.

As a part of the preparation of the series Mr. Schmitt is now traveling through the West, visiting irrigation projects, studying developments and interviewing builders, operators and settlers. He is writing this series of letters of running comment on the situation as he sees it on the ground. These are not the final result of his trip but they will serve to acquaint our readers with the actualities of reclamation as revealed to an unprejudiced investigator.

This is the fourth letter. The first appeared in the issue of October 4.—*Editor.*

Portland, Ore.

Complaints Against Increased Costs—A common matter of complaint by farmers on the reclamation projects is the high cost of the works, and more particularly the excess of cost over what was originally estimated or (as they say) promised. This subject seems to have been a source of animosity from an early period.

A newspaper editor who has lived near the Uncompahgre Reclamation project for many years says that he saw the engineer's original memo giving $22 as the construction cost per acre, with a safety margin. The project has cost $70 per acre and may cost more if drains are built. He protested against the injustice of burdening the farmers with excessive construction costs and said that unforeseen troubles and costs should be borne by the government, just as a contractor sticks to his bid and puts the job through even at a loss.

In Idaho, on the north unit of the Minidoka project, a representative of the water users complained of the effect upon the farmers of what he called the wrong estimates of the engineers. He claimed that the first announcement of cost was below $25 per acre, that later, on account of building laterals, the figure was raised to $30, and that now it is $42 because of expenditures for drains.

The facts are that in every case after a cost had been definitely announced each proposed increase in expenditure was discussed with the water users and carried out only with their approval; that the first plans for many projects contemplated building only the main supply lines; and that the data which answer complaints and criticisms like the above are available to the leading men among the farmers. The case of the Uncompahgre costs was fully dealt with by Arthur P. Davis in a statement presented before a congressional committee last winter. The Minidoka people know that their costs are moderate. Complaints against costs are repeated probably because they are convenient talking points rather than because they represent genuine grievances. The costs in all cases represent necessary investment to make the land productive.

Laterals and Drainage—From their early days the needs of the reclamation projects have expanded. Originally it was the plan of the Service to build in the way that most private or group irrigation systems had been built, that is, to provide the supply (storage or diversion) and main canals, leaving the farmers individually or in small groups to dig their lateral ditches. Even today most private systems are on this basis. But the government settlers needed to have the laterals brought to them. The Service therefore built canals up to each farmer's land. Even so, an occasional farmer complains because the government did not carry its ditch to some other point of his farm, that would suit him better.

Drainage became necessary later. It does not appear to have been foreseen in the original planning that continuous irrigation would raise up the ground-water contours and in time waterlog the lower points of the area. Drainage ditch construction has had to be undertaken on an extensive scale by the government. The drainage is being steadily extended on most projects, as the ground-water surface has not yet reached a stable level even after fifteen or twenty years of irrigation. Incidentally, exactly the same is true on private projects, and the South Side Twin Falls district, some distance west of Minidoka, is now busily engaged in drainage work, though it has been in operation for more than fifteen years and is underlain by hundreds of feet of fissured lava beds with free vent to the Snake River Canyon, along one edge of the area.

There have been some increases in cost due to unforeseen natural obstacles—as the construction difficulties of the Gunnison tunnel supplying the Uncompahgre project, which made the contractor abandon the work and required the Service to complete it—or due to changes in labor cost and the like. In some cases too, there has been unfortunate concentration of cost, as when the irrigable area was reduced by abandoning part of the land so that the remaining land was made to bear all the costs. But the reclamation farmer has not been burdened with the costs of waste or failure, as represented by the Jerome Reservoir in Idaho (private) or the Tumalo Reservoir in Oregon (State) both failures. The Reclamation Service has done its work well.

The aggregate fact is that irrigation costs are inevitably uncertain at the start, and that some misunderstandings may easily result herefrom. Again, however, private projects furnish parallels to the experience of the Reclamation Service. On the North Side Twin Falls project, says its manager, R. E. Shepherd, the original calculations of cost showed $25, $35 and $40 per acre, respectively, for three successive divisions, and land was sold accordingly (this was a Carey Act project); but the actual cost, with accumulated interest, today stands at $80 per acre, and on present sales this amount is asked.

Criticisms of Water Supply—There are some criticisms of inadequate water supply. This is a very natural subject for differences of opinion. The water required for good irrigation results depends on the soil, being greater for porous than for tight soil. In some districts it also depends on the salt content of water and soil, which may require excess water for leaching purposes. But in all regions it also depends on the farmer; he must give some extra attention and labor to use the water economically and to avoid waste by overflow. On the south unit of the Minidoka project, where all the water is pumped, the farmers' representatives claim that they are hampered by insufficiency of water in July, and a specially careful and thrifty farmer said to me that, while his crops are good, he thought he could do considerably better with more peak-season water. Leaching is not required at Minidoka. On the face of the crop records this unit is producing as well per acre as neighboring irrigation areas, which rather opposes the claim of harm from water shortage. As the pump and canal capacity do not permit of increased flow, moreover, one might expect the farmers to be content with conditions, at least for the present. That they are not, seems to be merely another illustration of the unrest, not to say demoralization, created by the element of politics in reclamation.

However a vote of the farmers on increasing the supply was taken at Minidoka, a few weeks ago, under orders from Washington; the proposition was defeated. It may be that the farmer's good sense is getting the better of political quarrelsomeness.

Construction Costs in France

Paris Correspondence

A REPORT of the Federation National Française du Batiment et des Travaux Publics has the following to say with regard to construction costs in France.

Construction costs are arrived at from the consideration of three principal elements—material and its transport, labor and general overhead.

Since 1914 prices of building materials in France have undergone important and frequent variations.

In the mass there was general and steady rise of material costs until 1920 when they reached their extreme height with a coefficient of increase (the quotient being the figure of 1914) between 4 and 5, on certain items even exceeding the latter figure.

A notable fall in the prices of many items was remarked in 1921 and continued progressively until the beginning of 1923, at which time the prices in general began to climb again, without however, having, as yet, reached the figures of 1920. This situation of 1923 is laid to two causes, the increase in the cost of combustibles and the high rates of foreign exchange.

In general, wages have undergone notable increases and overhead expenses have continually increased by reason of various forms of taxation which today apply to the contractor and construction engineer which hitherto had no part in the fiscal policies of the government.

Summing up, it was estimated that construction costs were 3.5 times as high as in 1914. Taking into consideration interest charges and the value of money in the financial market the owner of a rented building was justified in charging four times a pre-war rental, assuming that it was a new building with which he was dealing.

U. S. Weather Bureau Aids Rain Insurance

Many insurance companies have been working on the question of the risk involved in insuring entertainments such as fairs, fashion shows, ball games, balloon races, stock exhibits, etc., against poor gate receipts because of rainy weather. While rain insurance is a private enterprise, the U. S. Weather Bureau is called on to furnish data as to the frequency and amount of rainfall in given places at stated seasons, or otherwise to supply information that will aid rain insurance companies to estimate their risks and adjust their rates.

Modern Steel and Reinforced-Concrete Structures Survive Japanese Earthquake

Report of John W. Doty and W. W. Johnston, American Engineers, Gives Results of Survey in Yokohama and Tokyo After Disaster of Sept. 1

The first authoritative information regarding the condition of engineering structures after the earthquake and fire which destroyed portions of Yokohama, Tokyo and other smaller municipalities of Japan on Sept. 1 is contained in a report to the Secretary of State, Washington, D. C., prepared at the request of Ambassador Woods by John W. Doty, president, and W. W. Johnston, engineer, the Foundation Co., New York, who were aboard ship in Yokohama harbor when the quake occurred. This document, the source of the information which follows, adds a great amount of detail, based on personal observations of the two American engineers from Sept. 1 to Sept. 12 in both Yokohama and Tokyo, to Mr. Doty's diary published in "Engineering News-Record" of Oct. 4, p. 569.—EDITOR.

THE FIRST earthquake shock occurred at 11:57 a.m. Sept. 1, causing the greatest damage in an area of about 80 miles, north and south, and 65 miles, east and west, centering in the neighborhood of Yokohama. The quake at Yokohama seemed to be continuous for a period of from 40 to 60 sec., and was followed by repeated shocks of lesser intensity over a period of five or six days. About 700 shocks were counted during the first four or five days. A report issued by the Japanese Government on Sept. 4 stated that there would be at least an additional 300 shocks before the earth's surface would readjust itself.

Tokyo, the capital and largest city of Japan, has a population, including suburbs, of more than 3,000,000. It is about 18 miles from Yokohama, the seaport, which has a population of 423,000. Japan itself has a population of 56,000,000. The area seriously damaged by the earthquake contains about 4,500,000, or 8½ per cent of the total population.

On Sept. 3 Mr. Doty and Mr. Johnston began an inspection of the effects of the earthquake on various types of structures in Yokohama and Tokyo. From their joint diary of this trip the following excerpts are taken:

QUAKE'S EFFECTS IN YOKOHAMA

The sea walls along the waterfront at Yokohama were seriously damaged and portions of them overturned. The first structure of note was the bridge across the canal at the south end of the Bund. This was a modern riveted-steel structure about 100 ft. in length. The superstructure was not damaged but the wing walls of one abutment were broken and the approaches to the bridge had settled some 2 or 3 ft.

We walked along the Bund where all the buildings were completely destroyed and there were many fractures noticeable in the streets. The walls of the City Hall were standing but the whole inside of the building had been burned. The street was a mass of fallen electric service wires and at the junctions of the streets it was in places difficult to get through them. A large reinforced-concrete building of some six stories facing the end of that street had been completely burned, but the concrete frame and floors appeared to be undamaged by either the earthquake or the fire. We passed the Chamber of Commerce, a brick building of 3 or 4 stories with a clock tower 100 ft. high. This building was destroyed by fire, but the walls and tower were standing.

The Yokohama Specie Bank, a three-story structure 200 ft. square, equipped with steel fire doors and shutters which had been closed prior to the fire from the outside, appeared to be the only building in this part of the city which was intact. It was subsequently rumored that the building had been destroyed inside by

DAMAGE ALONG THE BUND, YOKOHAMA

fire which had gained access through the roof. This we were not able to verify.

We passed along the main street where most of the structures were of the older type with brick walls and probably wooden floors and partitions. All of these buildings were totally destroyed and most of them appeared to have collapsed prior to the fire, and no wood or other burnable material was to be found amongst the wreckage. This would indicate the tremendous heat of the fire. There were two small buildings of modern reinforced-concrete construction whose general framework seemed to be intact but the contents had been totally destroyed by fire.

The bridge in front of Sakuragicho Station, which is a modern structure, seemed to be in fairly good condition, although the street approaches had settled. In this vicinity there were also large fractures in the ground, some of which were 18 in. wide, running at right angles to the canal and parallel to the main shore

of the bay a half mile away. This confirms the statement of some eye-witnesses that these fractures were parallel to the crest of the land waves which were plainly visible.

Crossing the bridge we arrived at Sakuragicho railway station. A few of the walls were standing but the structure was, for all practical purposes, totally destroyed and all the district around the station had been not only destroyed by the earthquake but also by the subsequent fires. Not even a wall was standing, but the brick retaining walls of the railroad embankment seemed to be intact.

Proceeding along the main road to the Yokohama station it was remarkable that the only two buildings remaining intact, a modern type reinforced-concrete and an old fashioned brick building, are side by side and show no indication of having been damaged by either earthquake or fire, although they are surrounded by complete destruction by both. Back of these buildings and against the hill some two blocks distant, the gasometer was uninjured, although the pumping station directly adjoining it was damaged by both the earthquake and fire, and all the other scattered houses along the hillside had been burned. In this section we saw two unburned street cars. Most of the main Yokohama Station had collapsed and had been damaged by fire although some of it was standing.

Under the bridge where the railway crosses the street at the Yokohama station there were many large fissures in the ground and beyond the bridge the street was practically covered with fissures. A 20-ft. embankment on the branch railway had been shaken down and the rails and ties remained suspended. Several structures between the railway and the waterfront remained standing and were apparently uninjured. It cannot be too strongly emphasized that, with the exception of those buildings named and a very few damaged dwellings in the foreign settlement on the Bluff, all of Yokohama has been completely destroyed.

Beyond Yokohama Station along the road parallel to the railway tracks a great many fissures occurred on the streets and practically all the distance to Tokyo. Along this road through Kanagawa and to Kawasaki, a distance of 2½ or 3 miles, all the buildings were destroyed by the earthquake and fire. The railway bridge out of Yokohama, which was constructed of deck plate girders spanning the canal was destroyed by fire. The girders sank vertically about 6 in. by the heat. The ties were completely burned and the rails, although remaining connected, were buckled, resembling a letter "S." This bridge was a two-span 4-track structure about 75 ft. long.

The fire ended very abruptly at a narrow street not more than 20 ft. wide. Along one side of this street the light frame houses had been completely burned, while across the street, although the houses of a similar type had collapsed into a mass of matchwood, they had not caught fire. From this point to the Rokugo River, about half way between Yokohama and Tokyo, there had been no general conflagration and comparatively few of the houses, which were all of native type, had collapsed in the earthquake, although many had been shaken and damaged.

Two railway bridges over the Rokugo River had been damaged but could be readily repaired. The wooden highway bridge on pile bents had been severely damaged by the sinking of two of the pile bents, but remained passable for foot traffic. On each side of and parallel to the river, fissures in the ground were noticeable for 200 ft. from the water's edge.

From the Rokugo River to Shinagawa and beyond, almost to Shiba Park in Tokyo, the damage visible from the road was comparatively small.

At Shiba Park it became evident that although certain districts in Tokyo had not been seriously damaged, in a large part of the city the destruction had been as complete as in Yokohama, and from Shiba Park to the Imperial Hotel many fires were still burning. We arrived at the Imperial Hotel at 7.45 p.m. and found it undamaged but in total darkness. We learned that the American Embassy had been burned and that the Ambassador had established headquarters at the Imperial Hotel.

Damage in Tokyo

In Tokyo an area of approximately 30 sq.mi. was completely destroyed. In this area a small portion known as the Marunouchi district, which included a number of large bank buildings, new office buildings and the Tokyo central station, and a section which included the Peers' Club, the Imperial Hotel and most of the various government buildings were only partially destroyed. That part of the city outside of the completely destroyed districts was severely damaged by the earthquake and isolated fires probably to the extent of 25 per cent of its value. It is estimated that between 60 and 70 per cent of the total property value of the city of Tokyo was destroyed.

The buildings which existed in Tokyo can be classified under five heads: (1) Native frame houses constructed principally of pine; (2) small structures with brick walls and wooden interiors; (3) larger government and office buildings of heavy exterior and interior brick walls, with wooden floors; (4) modern buildings of four to eight stories with structural steel frames and fireproof or slow-burning walls and floors; (5) reinforced-concrete buildings of from two to eight stories with concrete floors, exterior walls of concrete, or veneered with masonry or stone. Probably at least 80 per cent of the buildings in the city were of frame construction, 15 per cent of brick and frame, and 5 per cent of the remaining three types referred to above. Buildings are limited by law to a height of 100 ft.

In the area totally destroyed by the earthquake and fire all the buildings, irrespective of classification, were destroyed, the framework only of a few isolated reinforced-concrete buildings remaining standing. In a small unburned area from the government buildings near Hibiya Park to the Marunouchi district, with comparatively wide streets and a number of open spaces, containing principally massive or modern buildings of substantial construction, practically all the structures were more or less damaged by the earthquake, but only a few of them collapsed, although a number of them were burned. This area was saved from the general conflagration principally by a change in the direction of the wind, which caused the fire to turn back just before it reached this district.

Our observation of some of the buildings which remained standing was in general as follows:

Imperial Hotel—The building was standing practically uninjured. Following the moat toward the Marunouchi district from the Imperial Hotel, the Life Insurance Co.'s office building, a modern structure, was

not damaged by the earthquake and fire, although directly behind it a large three-story frame structure had burned.

Police Headquarters—This heavy governmental type of structure had withstood the earthquake but had been gutted by fire some time later.

Imperial Theater—The roof of this building, a modern structure of its type, collapsed on the first shock, and fire, which started from within, burned the whole interior but most of the exterior walls are standing. This example shows the necessity, in earthquake zones, of strongly buttressing the side walls and practically bridging the roofs in theaters or similar structures with large roof spans. If a large number of people had been in the theater at the time of the earthquake probably none would have escaped.

The Kaikwan—This structure, known as the Palace Restaurant, next beyond the Imperial Theater, was a modern steel-frame structure of six stories. The shock

COLLAPSED PIER IN YOKOHAMA HARBOR

WAREHOUSE DAMAGED AS PIER SUBSIDES

of the earthquake caused the outside walls and the interior partitions of the third story only to shatter and fall, leaving every steel column on that floor exposed. The lower two stories and the upper three stories appeared to be only slightly damaged. The exposed steel columns of the third floor were bent out of plumb, however, and the upper three stories were thrown on an offset of approximately 15 in. from the line of the lower two stories. The building had not been damaged by fire.

There were a number of structures beyond the Kaikwan which were only slightly damaged by the earthquake and fire. These were principally three or four stories in height, of ordinary brick construction. Nearby, the structural steel framework for a new building which was being erected had collapsed and carried down with it some 200 workmen. In erecting steelwork where earthquakes are liable to occur each floor should be riveted and sufficient sway-bracing should be embodied in the design to make the frame of the building independently strong.

N. Y. K. Building—A new, modern, 6-story structure, which had just been opened, was of structural steel with very heavy masonry and brick walls. The exterior walls enclosing the second story were fractured by the earthquake, and cracks in the wall formed a distinct X in each panel running diagonally from top to bottom. The first story and the stories above the second appeared uninjured.

Marunouchi Building—A modern steel-frame office building of six or seven stories occupied an entire block. Although the building stood, some of the outside veneer was fractured or had fallen off. Across a wide plaza from the Marunouchi Building the Tokyo [illegible] Station and Hotel, a massive brick-and-steel [illegible]ture of four stories, was not seriously damaged [illegible]ther the fire or the earthquake. The Kaijo Building [illegible] modern six or seven story office building, having [illegible]ructural steel frame and brick exterior walls. The [illegible] of this building were shattered throughout and in places had fallen to the ground, exposing the steel [illegible]. This building did not take fire. The Industrial Bank Building, probably the most modern building of its type in Tokyo, which had just been completed, the frame being either of reinforced-concrete or steel (our impression is reinforced concrete) seemed to withstand the earthquake without any damage whatsoever, even the large windows being unbroken.

Bank of Japan—This structure, outside the Marunouchi district and across the canal, is of old type, with heavy masonry walls. The fire doors and shutters were closed and most of this building seemed to be undamaged by either the earthquake or fire. It is the only building of importance in the totally burned zone that is now standing in usable condition. All other structures in its vicinity, including the Mitsui Building and the Mitsukoshi Department Store, were burned, but the frames of a number of modern structures of reinforced concrete type remained standing, although the buildings had been gutted by fire and, in many cases, the exterior walls thrown down. In the greater portion of the 30 sq.mi. of the totally destroyed area, however, few frames or walls of any description remain standing.

Most of the small canal bridges of modern construction seem to be little damaged.

In reconstructing Tokyo a proper building code should be adopted to minimize, as far as possible, damage by earthquake and, what is much more serious, the spread of fire, as the destruction by fire was far greater than by the earthquake.

Most of the isolated government buildings of heavy brick type of construction, located south of the Imperial Palace Grounds and west of Hibiya Park, were not seriously damaged by the earthquake or fire.

Interview with John W. Doty

In an interview with a representative of *Engineering News-Record* last week, Mr. Doty amplified some of the points covered in the foregoing report. He emphasized the fact that the earthquake alone was not responsible for the widespread damage done in Yokohama and Tokyo. The toll both in lives and in property damage was greatly increased by the fire which swept over the stricken cities after the shock. In any program of

reconstruction, therefore, Mr. Doty believes that the provision of fire zones and the widening of the old narrow, twisting streets assumes an importance equal to the building of modern engineering structures of reinforced concrete or steel, designed to resist earthquake shock.

"I believe I am well within the facts," said Mr. Doty, "when I state that 95 per cent of the real engineering structures of modern design in Japan withstood the earthquake. Many of these structures were later gutted by the fire, but, regarded solely from the structural standpoint, they proved adequate. In some cases, of course, the curtain walls on these modern structures were shaken down, but the main framework stood up and the damage was comparatively slight. With our present-day knowledge of building design and construction methods, we can produce structures for which I would have no fear in the event of a repetition of the earthquake shock of Sept. 1."

The big lesson to be learned from Japan's disaster, according to Mr. Doty, is the necessity of having the columns, walls, and floors of structures tied firmly together, forming, in effect, a rigid cage.

"Many people," Mr. Doty continued, "have a false conception of the action of an earthquake. It is not a single shock, like a quarry blast, for example, but is a series of violent oscillations extending over a considerable period—in the case of the shock at Yokohama from 40 to 60 sec. On a building whose main elements are not well tied together the effect of a quake is like that of a battering ram. During the first few seconds, if the structure be improperly designed, gaps will be opened between the floors and side walls. Into these openings will fall material shaken down from above. Beams, girders and flooring moving back and forth rapidly like the piston in a steam engine literally batter down the side walls of a building. This result, of course, cannot be produced if the parts of the structure are integral. The action on a building, during a quake, is comparable also with that of cracking a whip. The structure is actually a cantilever with its top end being snapped back and forth. It is necessary, therefore, to design the structure to resist great shearing stress."

In the case of reinforced-concrete structures Mr. Doty believes that resistance to earthquake shock can best be accomplished by casting the walls and columns as a unit, in this way tying the structure together. Japan's building laws at present limit the height of structures to 100 ft. Mr. Doty considers this restriction reasonable and would even go further, by reducing the figure to 75 or 80 ft., resulting in a building with a maximum of about six stories.

Japanese cities inherited from the days of the old empire flimsy structures of wood and brick, often covered with a heavy tile roofing. Unprovided with sway bracing, the walls during a shock would spread, allowing the roof, with its heavy load of tile, to collapse. It is probable, Mr. Doty believes, that these old types of structure will not be rebuilt. In replacing the smaller residence buildings he sees an opportunity for the effective use of asbestos shingles for roofing.

It is Mr. Doty's opinion that the results of the earthquake indicate that for moderate sized structures reinforced concrete is well adapted to resist shocks, while for the larger office buildings and other commercial structures either reinforced-concrete or modern skeleton steel-frame types will be found adequate. For the smaller structure he pointed out substantial economies in favor of reinforced concrete as compared with structural steel.

There is no doubt in Mr. Doty's mind that in the rebuilding of Yokohama and Tokyo modern methods of design and construction will be largely employed. It is significant that the Japanese government has ruled that only temporary structures may now be rebuilt without a permit. Due to rapid commercial developments land values in the larger Japanese cities have been increasing at a rapid rate, making uneconomical the low, old-fashioned structures in which Japanese business was housed. This will mean, it seems probable, taller and stronger structures.

If any larger-scale building program along modern lines is adopted, it is certain that Japan will call upon other nations, the United States and England particularly, for modern construction equipment and supplies. While the Japanese, during the last generation or two, have made substantial progress in modernizing engineering design, they are not equipped, as is the United States, with the machinery and tools to prosecute work according to American construction methods. The hazards of earthquakes, Mr. Doty believes, need not be regarded as a bar to the profitable investment of foreign capital in Japan, for the recent disaster has demonstrated conclusively that modern methods of building design and construction can be depended upon to produce structures that will stand up if adequate attention to the structural features of the problem is supplemented by intelligent planning to prevent the spread of fires.

Another A.I.C.E. Ethics Committee Case

AT A meeting of the American Institute of Consulting Engineers held recently, the Committee on Professional Practice and Ethics presented its report on a hypothetical question known as Case No. 21. The two phases of this Question and Answer, as reported by F. A. Molitor, secretary of the Institute, are reproduced herewith.

Question 1—When a member of the Institute has a partner who is not a member of the Institute and that partner, without his knowledge or consent, conducts himself otherwise than in accordance with the Code of Ethics of the Institute, what duty, if any, does the member of the Institute have to his brother engineers and the public with respect to the conduct of his partner? *Answer*—It is the duty of the member of the Institute to induce his partner to shape his conduct so as to harmonize with the ethical principles which the Institute has laid down for the conduct of its members, and failing to do so he should consider it his duty to sever his connection with either his partner, or the Institute.

Question 2—When an engineer, being a member of the Institute, conducts his professional practice through a professional service corporation, and representatives of that corporation, not under his direct control, conduct themselves, and the business of the corporation, otherwise than in accordance with the Code of Ethics of the Institute, what duty, if any, devolves upon the member of the Institute with respect to his brother engineers and the public? *Answer*—It is the duty of the member of the Institute to induce the responsible representatives of the professional service corporation so to conduct themselves and the business of the corporation as to harmonize with the ethical principles which the Institute has laid down for the conduct of its members, and failing to do so he should consider it his duty to sever his connection with either the professional service corporation or the Institute.

Industrial Waste Pollution Conference a Success

Held at Philadelphia Under Joint Auspices of Engineers Club and Local Section, Am. Soc. C. E.

A WELL-ATTENDED conference on the pollution of streams was held on the afternoon and evening of Oct. 16 at Philadelphia, under the joint auspices of the Philadelphia Engineers Club and the Philadelphia Section of the American Society of Civil Engineers. Among the hundred or so at the conference were many well-known sanitary engineers from New England and the Middle Atlantic States and also a goodly representation of conservation commissions and of the oyster, paper, and other industries. Among the topics on the program were federal and state control of pollution, stream pollution as affecting navigation, industrial wastes in relation to water supply, stream pollution at Philadelphia, and coal mine drainage contamination of water supplies.

The stream pollution investigations of the United States Public Health Service were briefly outlined by Surgeon W. H. Frost, who stated that so far as he can judge the chief interest now lies in the organic pollution of streams and resulting nuisances, but added that the time would doubtless come when consideration could be given to the effect of distant bacterial pollution on public water supplies. George T. Hammond, consulting engineer, Brooklyn, said that perhaps sanitary engineers are chiefly interested in the effect of stream pollution upon the bio-oxygen demand especially in connection with sewage-works. H. P. Eddy, consulting engineer of Boston, spoke of the tremendous effect of very few industries upon the character of the streams. He mentioned the three rubber reclaiming plants at Akron, Ohio, which together contribute 117 lb. of solid wastes to the river for each 100 lb. contributed by the city sewage.

Government Control—In the course of his presentation of Government Control of Pollution, C. A. Emerson, Jr., formerly chief engineer of the Pennsylvania Department of Health and now associated with the Philadelphia office of Fuller & McClintock, consulting engineers, remarked that about 80 per cent of the state health departments of this country now have sanitary engineers. Mr. Emerson spoke approvingly of the methods of control of stream pollution employed in Great Britain, where joint commissions or river boards having charge of entire drainage districts prove useful. These boards are generally large, their membership extending to 25 or 30, and the members being elected by the local governing boards of each municipality in proportion to population. There are similar boards in Germany, but some of these, like the Emscher District Board, have representation by industries, as well as by municipalities. There is a notable difference between available machinery for the control of stream pollution and health matters in Great Britain and Germany, on the one hand, and in the United States on the other. Whereas the two former countries have national health departments, we have none in this country. Mr. Emerson expressed the opinion that any centralized control of stream pollution in the United States would not be welcome if it were designed to set aside state agencies, but thought that [illegible] means might well be devised for federal co-operation [illegible] stream pollution control.

An outline of "The Powers, Duties and Policies of the Sanitary Water Board of Pennsylvania," presented by W. L. Stevenson, chief engineer, Pennsylvania Department of Health and secretary of the board just named, was an outstanding feature of the conference. *(An abstract of Mr. Stevenson's paper follows on p. 684.)*

Sanity and Adaptability—The discussion on Mr. Stevenson's paper was opened by H. P. Eddy, of Boston, who said the code goes a long way in the direction of sanity in the control of industrial wastes. In general, there should not be an attempt to compel each industry on a stream to comply to one standard or any industry always to try to attain the same standard for that industry. State control should not establish arbitrary rules or standards, but instead should require cessation of pollution without saying how, since if an attempt is made by the state control body to define methods of stopping pollution and the methods proposed are followed and results are not satisfactory, there may be serious embarrassment to the control body.

By way of illustration of elasticity of means of preventing stream pollution through variation of the methods employed to suit temperature and river stages, Mr. Eddy stated that a tannery in Massachusetts employs varying degrees of treatment at different seasons of the year to meet fluctuating conditions. At times of low stream flow, treatment is supplemented by dilution from water stored for the purpose. When both treatment of the wastes and stream dilution are not sufficient or water enough for dilution is not available, then, as has been done this year, the stream is dosed with nitrate of soda in order to increase its available oxygen.

Col. George A. Johnson, consulting engineer, New York City, complimented Pennsylvania on being the first state to attempt the control of pollution of streams from their source to their mouth. He remarked on the fact that if 100 per cent treatment of industrial wastes were required some industries might be financially ruined or driven from the state. Robert S. Weston, consulting sanitary expert, Boston, spoke a word in behalf of manufacturers, most of whom he thinks are favorably disposed toward the prevention of stream pollution. In support of the latter opinion co-operation of owners of industrial plants in Rhode Island was cited.

George W. Fuller remarked on the great difference between theory and practice in government control. The first British Rivers Pollution Act of the seventies was on the statute books some fifteen years before much was done to comply with its requirements. Little was accomplished until the rivers boards mentioned by Mr. Stevenson were created.

Progress resulted when a balance was established between what is being done by the municipalities and by the industries to stop stream pollution. Mr. Fuller stressed the point that consideration should always be given to whether money could be better spent for the prevention of river pollution or for some other public purpose, like the building of parks and playgrounds or providing other recreational facilities. Speaking for the second time on Mr. Stevenson's paper, H. P. Eddy stated that in stream pollution control the rule of

reason must be followed. J. F. Jackson, engineer, Connecticut Board of Health, also emphasized the fact that success in stream control depends upon the wisdom shown in both drawing and enforcing regulations.

Dr. W. H. Frost, surgeon, U.S.P.H.S., referring to remarks by Mr. Emerson to the effect that there was a diversity of laws regarding stream pollution in the different states, said that the administration of the laws was far more uniform than the laws themselves, this being due to the fact that the administration is in charge of men who are working along common lines arrived at in part by the conferences of state sanitary engineers that are held each year.

Remarkable New Filter—The "Stream-Line Filter" was described in a paper by George W. Fuller, consulting engineer, New York City, as "one of the most interesting exhibits at the shipping, engineering, and machinery exhibition at Olympia, London, last month." This filter is the invention of Dr. H. S. Hele-Shaw, president of the British Institution of Mechanical Engineers last year. It consists of a pack of specially prepared paper held together between two press-heads. The liquid to be filtered is forced through the filter between the sheets of paper and the pressure is varied according to the character of the liquid or of the material which it is desired to abstract. An abstract of Mr. Fuller's paper will appear in a later issue.

Navigation—"Stream Pollution as Affecting Navigation" was the title of an address by F. C. Boggs, colonel, Corps of Engineers, U. S. A. Federal control comes through the interstate commerce clause of the constitution and is administered by the Corps of Engineers, Col. Boggs said. Navigable waters are construed as being any waters that will float logs. In the control of navigation the army engineers have no jurisdiction over pollution as such. What they do control is (1) solids which may impede or cause deposits that will impede navigation and (2) semi-solid matters injurious to shipping. It has been held that (2) does not include oil but Congress could legislate on that subject. In fact it has legislated so far as New York harbor is concerned where oil discharges are under the control of the supervisor of the port. The present oily wastes from ships in New York harbor are pumped from the ships and the oil is recovered by a private company. There is need for a separator available for use on each ship.

As to remedies for the oil nuisance, Dr. Frost said that the enactment of laws is first thought of but if enacted who would enforce laws? Again the first thought is the federal government. It is deeply interested, Dr. Frost said, but he did not suggest that it could undertake the work. He did say, however, that it appears that anti-pollution measures, like charity, should begin at home, making it the principal duty of the federal government to control interstate and international oil pollution. Too great a burden must not be thrown upon industries for ultimately this burden will be borne by Mr. Private Citizen.

Russell Suter, senior assistant engineer, New York Conservation Commission, Albany, N. Y., said that there had formerly been much trouble from an oil refinery at Olean, N. Y. The Standard Oil Co. put in a plant for preventing stream pollution which is reported to be profitable. Other oil wastes, Mr. Suter said, are not so much different as would be thought and probably they also could be successfully treated. It has been asserted that oil wastes injure fish. Mr. Suter said he was not sure as to this, except that he had reason to believe that they do not injure shell fish. Morris R. Sherrerd, chief engineer, Department of Streets and Public Improvements, Newark, N. J., cited the Passaic River which was formerly much used for boating, but which sewage pollution had made useless for that and many other purposes. The expenditure of $20,000,000 by the Passaic Valley Sewerage Commission to prevent the pollution of this stream may perhaps restore boating to the river.

Pollution by automobile oils contributed to sewers from public and private garages was the subject of considerable discussion during the conference. The consensus of opinion seemed to be that this is a serious matter in many cities. In Philadelphia a city ordinance requires intercepting traps to keep the oil out of the sewers. There seemed to be some difference of opinion as to the effectiveness of this ordinance.

Public Water Supplies—A review of data on industrial wastes in relation to water supply, collected by a committee of the American Water Works Association, and presented at the recent Detroit meeting of the association, was presented by Almon L. Fales, of Metcalf & Eddy, Boston, chairman of the committee. The data show that some 250 water supplies widely distributed in the United States and Canada are affected by industrial wastes, and that of these 138 are in Pennsylvania alone. There are some 25 different kinds of industrial pollution. Over 100 water supplies are affected by mine drainage. The whole matter of control here should be considered from the broad viewpoint of public welfare. Investigation should precede legislation.

In discussing this paper, R. S. Weston said that the committee has made clear that it is not yet possible to satisfactorily treat all classes of industrial wastes. For instance, this has not yet been found possible with the sugar factory wastes in Cuba, which discharge into small or almost dry streams; also creamery wastes. We are still in need of technical as well as legislative and administrative progress. Mr. Weston said his own leanings are toward rivers boards working in co-operation with industries. Such co-operation is being obtained in Rhode Island through the work being done by Stephen DeM. Gage and the Rhode Island Board of Purification of Waters.

In a paper on "Stream Pollution in Philadelphia" Maj. J. A. Vogleson, chief engineer, Bureau of Surveys, said the problem of industrial wastes is inseparable from that of the general sewage of the city since the industrial plants are scattered throughout the city and discharge into the sewerage system. There are 162 outlets discharging into the Schuylkill and Delaware Rivers. Many years ago an intercepting sewer along a portion of the Schuylkill diverted sewage below the water intakes on that stream and later on other interceptors were built and some are now under construction for the further diversion of sewage from the tributaries of the Schuylkill and Delaware and for its delivery to three treatment plants. As an illustration of the progressive pollution of the Delaware River, Maj. Vogleson stated that in examining samples of the raw water taken from the Delaware River before filtration there were employed successively 1 c.c., 0.1, 0.01 and now 0.001 c.c. The first of the large sewage treatment

plants included in the plan adopted in 1916 for cleaning up the rivers, construction on which was postponed by the war until 1921, is about ready to go into operation. This includes 32 Imhoff tanks located about two miles below the mouth of Frankford Creek.

A striking example of the damage to sewers sometimes done by industrial wastes was cited by Maj. Vogleson. About 1,700 ft. of invert of a concrete sewer was ruined within three weeks of the time that there began to be discharged into it some heavy acid wastes from an industrial plant. This sewer is of the basket section type, equivalent in cross-sectional area to about a 7-ft. circular sewer. The invert to a width of some 30 in. has been badly damaged, the acids in some cases penetrating to a depth of 7 or 8 in. It is estimated that it will cost $70,000 to repair this stretch of sewer.

Coal Mine Drainage—In a paper on "Coal Mine Drainage Contamination of Water Supplies" J. W. Ledoux, consulting engineer, Philadelphia, reviewed the problem, particularly as it is presented in Pennsylvania, and outlined some possible means of treating mine drainage. This paper followed somewhat the same general lines as the one presented by Mr. Ledoux some months ago before the Pennsylvania Water Works Association, as abstracted in *Engineering News-Record*, April 19, 1923, p. 698. The possibilities of using barium oxide or hydroxide for the purification of coal mine water were discussed by Mr. Ledoux who concluded as the result of his investigations that this is the only satisfactory chemical to use and that while the cost would be prohibitive without the utilization of the byproduct—barium sulphate—yet by such utilization it would be practicable. Mr. Ledoux said: "With an average mine water containing over 2,000 p.p.m. total solids and over 1,000 p.p.m. sulphate it would require in the neighborhood of 7½ tons of barium oxide per million gallons, and there would be about 13 tons of barium sulphate as a byproduct."

In discussing this paper, R. C. Bardwell, of Huntington, W. Va., said that when legislation against water pollution by oil wells in Kansas was enacted he was told that nothing would come of the legislation if its enforcement was likely to be a handicap to a basic industry of the state. The legislation proved to be of no effect. This would be the case with any legislation against coal mine drainage, Mr. Bardwell said. He urged that consideration should be given to the burden placed upon water users and water consumers by industrial wastes, and stated that it has been estimated that a group of Ohio River steam plants are burdened with an expense of $2,000,000 a year on account of stream pollution. How these evils can be corrected has not yet been determined. Co-operation seems to be the most promising way. Self-help in this direction is illustrated by what one railway did in Illinois. It stored water when it was usable against the time when it would be bad.

Terminal Engineers Hear Weather Talk

The Municipal Engineers of the City of New York at their meeting Oct. 24 were given an address on the work of the weather bureau and its relation to the welfare of the public, entitled "Is It Going to Rain?" by James H. Scarr, meteorologist of the U. S. Weather Bureau in charge of the New York district.

Pennsylvania Sanitary Water Board: Powers, Duties and Policies

By W. L. Stevenson
Chief Engineer Department of Health, and Secretary, Sanitary Water Board, Harrisburg, Pa.

Abstract of a paper presented to the Conference on Pollution of Streams Held by the Engineers' Club of Philadelphia and the American Society of Civil Engineers (Philadelphia Section) at Philadelphia, Oct. 16, 1923.

ONE of the principles of reorganization of the State government of Pennsylvania proposed by Governor Pinchot [on coming into office early this year] was the coordination of duties and authority having a common purpose and to that end "The Administrative Code," approved June 7, 1923, created in the Department of Health the Sanitary Water Board to have jurisdiction over stream pollutions of all kinds.

This Board consists of the secretary of health, as chairman, the secretary of forests and waters, the attorney general, the commissioner of fisheries and the chairman of the Public Service Commission. The powers and duties of the Sanitary Water Board include: (a) The administration of the laws of the Commonwealth prohibiting the pollution of the waters of the State; and (b) the study, investigation and reporting upon ways and means of eliminating and preventing stream pollutions which are detrimental to the public health, the health of animals, fish or aquatic life or to the recreational use thereof.

The principal advantages to be obtained from vesting all the anti-stream pollution laws in a board instead of separate administration as heretofore are uniformity of policy and the classification of streams to provide for the several kinds of uses of the waters of the State and expediting action in cases involving the jurisdiction of the several departments concerned.

Fundamental Policies—The Sanitary Water Board has established a number of fundamental policies through the adoption of resolutions. The first of these resolutions approved certain policies of the Department of Health relevant to sewerage and stream control, including the following: (1) That streams which are used as sources of public water supply after filtration should, in addition to being reasonably clean, provide a raw water sufficiently low in organic and pathogenic bacterial content that it can be safely and reasonably economically purified for domestic purposes. (2) That streams which are used as sources of public water supply with only chlorination should be kept free from all artificial sewage pollution unless adequate assured long-time storage is used for the water supply and in such cases the sewage effluent should be adequately disinfected as a further safeguard. (3) Requirements made to restore sewage polluted streams, not used as sources of public water supply, or to maintain clean streams in a clean condition should be begun at the head waters and progress down stream. (4) Requirements made to protect sources of public water supplies should be, in general and subject to local conditions, begun at the first source of sewage contamination above the water-works intake and progress up stream. (5) The agreement between Pennsylvania and New Jersey establishing a "Uniform Policy as to Degree of Treatment of Sewage Discharge into the Delaware River" (see *Engineering News-Record*, Aug. 10, 1922, pp. 215 and 243).

Classification of Streams—A resolution of the Sanitary Water Board adopted Aug. 8, 1923, for Classification of Streams, is as follows:

Whereas, The degree of pollution of the waters of the State varies widely from the pristine purity of a small stream flowing through a virgin forest to the grossly polluted stream draining a valley given over to intense municipal and industrial development, and

Whereas, Such differences in condition and the present and probable future use of the streams must be recognized in determining the required degree of treatment of sewage and industrial wastes, and

Whereas, The natural powers of streams to inoffensively assimilate and dispose of polluting matters by dilution must be utilized so far as compatible with the general interests of the public in order to establish a practicable and economical program for stream control, therefore

Resolved, That the waters of the State be classified as follows:

Class A: Relatively clean and pure streams—streams in their natural state probably subject to chance contamination by human beings but unpolluted or uncontaminated from any artificial source, hence generally fit for domestic water supply after chlorination, will support fish life and may be safely used for recreational purposes.

Class B: Streams in which pollution shall be controlled—streams more or less polluted, where the extent of regulation, control, or elimination of pollution will be determined by a consideration of (a) The present and probable future use and condition of the stream; (b) the practicability of remedial measures for abatement of pollution, and (c) the general interests of the public through the protection of the public health, the health of animals, fish and aquatic life, and the use of the stream for recreational purposes.

Class C: Streams now so polluted that they cannot be used as sources of public water supplies, will not support fish life and are not used for recreational purposes and also from the standpoint of the public interests and practicability it is not now necessary, economical or advisable to attempt to restore them to a clean condition; and further,

Resolved, That all artificial pollution of Class A streams shall be prohibited and any sewage or industrial wastes on the watershed shall be treated to such a degree that the effluent shall be practically free from suspended matter, non-putrescent and disinfected and that recreational use shall not be sanctioned within prejudicial influence of water works intakes, and further

Resolved, That the degree of treatment of sewage and industrial wastes discharged into Class B streams shall be determined for each particular stream or portion thereof after consideration of the general interests of the public and the economics of the particular case, and further

Resolved, That sewage and industrial wastes may be discharged into Class C streams; provided, however, that such discharge shall not create any public nuisance or menace to health.

Clean Streams Must Be Kept Clean—This resolution establishes the policy that streams now relatively clean and pure shall be kept in that condition. No future pollution thereof will be permitted. It also recognizes that, due to existing intense industrial development on certain watersheds, the streams thereof have become so polluted that they are now totally unfit for use as sources of public water supply nor will they support fish life and hence are practically set aside for the disposal of industrial wastes. The cost of construction and maintenance of works for the abatement of the pollution of such streams will far exceed the value of the benefits to be derived by the public through their restoration to a clean condition. Therefore, efforts will not be made, at this time, to accomplish any more than the prevention of menace to the public health and creation of nuisance in streams which may be designated as Class C.

The majority of the larger streams draining developed areas will naturally be found in the middle group, designated as Class B. The resolution recognizes the natural powers of streams to inoffensively assimilate a certain amount of polluting matter and that the use of the scientific method of disposal by dilution is essential to the success of any program for stream control because of the economics of the problem. The usual requirement to be met in determining the pollution load which a stream can receive when considering disposal by dilution is the maintenance of the stream in a cleanly condition as measured by sight or smell. But when the Sanitary Water Board designates any stream as Class B it will also determine the degree of treatment of polluting matter and this will be based upon the use and condition of the stream both at present and in the probable future in order to compare the cost of treatment on the one hand with the value of the benefits to the public obtained through protection to sources of public water supplies, fish life and recreational use of the stream.

Co-operation Essential—The co-operation of municipalities and private persons and corporations with the State is essential to the success of the comprehensive program of the Board for stream control and hence a resolution has been adopted authorizing the Secretary of Health to notify all municipalities on the watershed of any stream that has been classified as to the required degree of treatment of sewage. Thus each municipality along the classified stream will know that as the means for abatement of pollution are progressively installed from the headwaters on downstream, they will benefit by the expenditures of their upstream neighbors and in justice they must do likewise for other municipalities situate on downstream.

Existing law requires the issuance of a State permit before public sewers can be constructed and provides penalties for unlawful discharge of sewage; hence, the Sanitary Water Board in administering the law will both confer privileges and impose obligations upon municipalities. The board has established the policy that good faith must be shown by municipalities in complying with requirements of sewage permits before they are granted further privileges or are relieved from penalties. For extending the limits of cleanliness of streams whose headwaters are not now polluted, plans have been made to have such streams examined by State employees whose regular duty includes the traversing of them in order to ascertain the first source of pollution and thereafter, if the board shall deem it expedient, means will be adopted to secure abatement. In this way the cleanliness of headwater streams will be gradually extended and increase the available sources of public water supplies, benefit riparian owners along the banks and provide more clean streams in the State for the pleasure of the public who are learning the healthfulness and value of recreation in the open through camping, hunting and fishing.

Complaints Must Be Concise and Well Founded—Various state officials and departments are constantly in receipt of complaints from the public concerning pollution of streams or the destruction of fish. Occasionally these complaints are concise and well founded, but generally they are vague and indefinite. The board has therefore established the policy that only well founded and concise complaints will be considered. Forms are sent to complainants in duplicate for furnishing the data and the statements made must be sworn to. Upon receipt of the properly filled in complaint form charging violation of law against any person, firm or corporation, the copy thereof is sent to the respondent who is afforded opportunity to make abatement or to submit defense of the charge in the complaint. After consideration of the formal complaint and the respondent's reply thereto, an investigation is made and if violation of law found and abatement is not made, prosecution is instituted. The board has by resolution placed the matter of handling complaints relative to destruction of fish with the Commissioner of Fisheries, pursuant to Section 501 of The Administrative Code.

The magnitude of the task confronting the Sanitary Water Board may be seen when it is realized that 13 per cent of the 4,419 named streams of Pennsylvania have drainage areas of over 25 sq.mi. and an aggregate length of 13,000 mi. and, by proportion, it is probable that the total length of all named streams is about 100,000 miles. Also it is estimated that the total average flow in Pennsylvania streams is at a rate of about 2,600,000,000 gal. an hour.

The sources of pollution are innumerable, diverse in character and of both public and private origin: there are 974 municipalities in the State of which only one-half have public sewer systems from which sewage or sewage effluent is discharged to the streams; also many towns have storm drains to which sewage connections have been made and countless private sewers discharge sewage.

It has been estimated that stream pollutions may be caused from about 2,500 industrial places representing a capital investment of over $1,000,000,000 and yielding products valued at over $1,500,000,000 a year. Hence the solution of the problem confronting the Sanitary Water Board must be approached sanely and deliberately with recognition of the financial aspects, so as to successfully carry out in an orderly and logical sequence, a comprehensive, practicable program for stream control in the Commonwealth of Pennsylvania.

A Half Day with Karl Imhoff

By W. W. DeBerard

Associate Editor Engineering News-Record

FOR THE first time in ten years Dr. Karl Imhoff, German consulting sanitary engineer and inventor of the two-story type of sewage tank bearing his name, has visited the United States. It was the writer's privilege to accompany him and Langdon Pearse, sanitary engineer, Sanitary District of Chicago, on a tour of inspection of the large Calumet sewage-treatment works where two-story tanks are used. I was anxious to learn of the doctor's reaction on seeing this plant, which is equipped with all of the essential labor and modern high-grade machinery for ideal operation. A gasoline locomotive was pushing into the sludge beds a train of a dozen side-dump sludge cars and half a dozen men cut lawn on the area saved for future use.

Ten years ago engineers by the score were visiting Germany asking all manner of questions, begging blueprints and eager for operating data because sewage-treatment plants of the biological type in the United States at that time were few and operation data scarce. For ten years Germany has built few sewage-works. "We are too poor," said the doctor. "Only those absolutely essential are even operated and it is surprising how few sewage plants are absolutely necessary. The tables are now turned. Within two weeks I have seen many works not in existence ten years ago. America now has taken the lead. The only activated-sludge plant in Germany is a unit at my laboratory."

At Calumet—Dr. Imhoff's first observation was of the incoming sewage. "The morning's grist," said Mr. Pearse, "rather fresh and well comminuted," the sewage having been through the centrifugal pumps and coarse screens. "It carries a lot of paper," I remarked. "Yes, American sewages always have much more paper than German sewages," said the doctor. Then we came to the chimney-like gas vents at the base of which was a thick heavy black scum, perhaps a foot or more thick. "Good," said the doctor. "But you must clean out the channels and add the scum to the sludge-drying beds." He could not understand a scum on the tanks which though not large in quantity was being skimmed off and dumped into the gas vents. The scum was greenish from algae and oily from garage discharges. "It is not solid material from the sewage," explained Mr. Mohlman, chief chemist for the Sanitary District, much to Dr. Imhoff's relief, for at first he thought that by some means the gas traps were not operating and sludge was being carried to the surface. He advised against putting this oily algal growth into the gas vents, for the whole must eventually be removed. This was just one indication of the little economies for which his eye had been trained in recent years to look.

Then we came to a tank with the sludge discharging by means of air lift, an inky black heavy liquid having the consistency of curdled milk and an odor not unlike fresh humus. "Good, proper and ripe," ejaculated the doctor. Farther along he hopped into a bed of dried sludge and brought out for inspection a cake 4 in. thick of dark brown porous cork-like humus with little or no odor which he proclaimed ideal. The bed had the characteristic irregular cracking after drying on the sand for two weeks.

"What causes the higher level of scum here, Doctor?" asked Mr. Pearse, as we came to gas vents nearly full of black foam. "Tanks which went into operation in the fall have given no trouble while those that were started in the winter have only settled down to regular work after considerable foaming."

"Acid methane formation in the winter," was the answer, "which did not permit the tanks to ripen all winter long. Then an accumulation of the wrong kind of organism persisted. The solution is to draw off the sludge frequently, probably twice a month."

Conditions in Germany—Dr. Imhoff indicated that many plants have been closed down there. Only the Ruhrverbund plants which discharge into the Ruhr River have to produce a high-grade effluent, for this is one of the few rivers used for water supply. The trend of present German practice is toward economy, both in operation and design. In extending the usefulness of existing plants, the period of settling has been shortened and existing sludge capacity increased by separate sludge-digestion tanks into which the fresh sludge, mixed with well-ripened sludge, is pumped. This has proved a practical way of taking care of the sludge, the mixture with well-ripened sludge giving inoffensive digestion. This practice is somewhat analogous to the practice of John D. Watson of Birmingham, England, who uses well-ripened sludge to seed the fresh sludge from septic tanks, in order to promote quick, inoffensive digestion.

The effect of heat upon the digestion of sludge is important. Probably the sludge chamber of the Imhoff tank is at a more uniform temperature the year around than in most tanks of other types and certainly more so than in the sludge-digestion experiments made in the United States, where the sludge is pumped into a separate basin and allowed to stand indefinitely and chill. Experiments are being conducted at Essen upon the effect of heat, both on Imhoff tanks and on separate sludge digestion, the heat being supplied by introducing small amounts of hot water every day through the sludge outlet pipe. A certain amount of liquor is likewise removed to even up displacement. The hot water is supplied by burning the gases from the gas slot under a small hot water boiler. Dr. Imhoff believes that the digestion of sludge should be more uniform and faster in a warmer climate where the sludge can be kept at summer temperatures the year around. (California and Texas engineers please note.)

"We are very poor," reiterated the doctor. "We must economize all we can. Some of our sewers are concrete-lined open trenches and recently in hunting for the cheapest kind of treatment we have found shallow sedimentation will give us a fair result compared with deep basins. In fact six basins not deeper than sludge beds have been built at one point. The area as well as depth is now taken into account in the latest design of the Imhoff tanks, whereas formerly we paid more attention to depth. We use less 'flowing through' depth and add as much depth as we can afford to the sludge-digestion chamber."

It is evident that necessary economy may force some interesting developments in German sewage-works. One last remark of Dr. Imhoff impressed itself on me in these days of the elevation of the so-called business man to administrative engineering positions: Although Germany has had a revolution the technical men in charge of technical works operation are not disturbed.

From Job and Office

Hints That Cut Cost and Time For the Contractor and the Engineer

Poured Construction Joints for Concrete Pavements

By J. G. Bragg
Senior Testing Engineer, N. J. State Highway Commission

ENGINEERS who favor the installation of expansion joints at frequent intervals in concrete roads may abandon their theory in favor of smoother riding qualities, knowing from experience the difficulties encountered in obtaining a "smooth-riding" joint. There has been considerable doubt also as to the effectiveness of the conventional type of pre-molded joint, and core drill operations have proven that few of these joints are set according to plans and specifications. They are thrown out of alignment or raised off the subgrade by removal of the bulkhead and frequently do not

JOINT FORM ALSO SERVES AS BULKHEAD

therefore insure a complete separation of adjacent slabs. A serious defect also of the pre-molded joint is the lack of bond between the slabs and joint material, expansion and contraction of the slabs permitting a separation or crevice in the joint through which surface water may reach the subgrade.

A new type of poured joint is being used to some extent on New Jersey pavements, and the results obtained to date are quite commendable. While poured joints are generally frowned upon because the cost of installation is considered to be prohibitive, the type under discussion has many features tending toward economy of operation, bringing it in close competition with the pre-molded joint. Briefly, the method consists of installing a corrugated paper bulkhead which is left in place without forming an obstruction to the strikeboards or finishing belts. This paper bulkhead is later removed, leaving a clean-cut opening of whatever joint width is desired, and this opening is then filled with a 40-60 mixture of pre-mixed asphalt and sand. During the process of pouring and finishing the concrete, a sheet-metal cap is placed on the top edge of the paper bulkhead. The paper for each joint is, of course, discarded but the same metal top caps are used repeatedly. The accompanying photograph shows the McGovern poured joint as it is being installed on a section of a New Jersey state highway. The main advantages claimed for this type of joint are:

Smooth-riding quality, uniform thickness of joint and complete separation of slabs, exclusion of surface water from joints, greater capacity for expansion of slabs, and less and more efficient maintenance.

Economizing Materials Storage Space in Building Construction

By Henry S. Hines
W. G. Wilkins Co., Engineers and Architects, Pittsburgh, Pa.

STORAGE and handling of materials in building construction is always a problem in metropolitan districts, where traffic is so great streets are not usable for storage. Methods used in the construction of the Atlantic Bldg., a 24-story structure recently completed at the corner of Broad and Spruce Sts., Philadelphia, are believed to represent about the best practice in materials handling.

The building occupies the lot from Spruce to Manning St. and Broad St. to a restricted areaway at the rear of the building line and the absence of any material stored on the streets has been very noticeable. The sidewalk along Spruce St. was removed and at the completion of excavation was planked over. Trap doors were cut in the planking, allowing the trucks to back up to the curb and dump all foundation concrete material directly into bins at basement floor level, from there it was handled into portable mixers set at convenient places in the sub-basement.

The steel frame was erected by using two 80-ft. boom derricks, placed in such positions so as to reach three sides of the building. All material was "picked off" the wagons and trucks and landed on the floors. Delivery was timed according to the speed of erection. After the first floor steel was set and riveted this floor was planked over solid and a driveway provided through the rear of the building from Spruce to Manning St. and down the center corridor from the Broad St. entrance. Under this driveway was placed the cinder and sand bins, mixer, etc., for the fireproofing.

A ¾-yd. bucket was placed in one of the elevator hatches and the cat head raised as each floor was poured. The elevator contractor followed the steel erection very closely with his main rails and the general contractor utilized these for his three material hoists, doing away with any street obstructions whatsoever.

The delivery of outside terra cotta, brick backing, window frames, etc., was made directly onto these hoists and distributed on their respective floors. A portable mixer was placed in the sub-basement near one hoist and all mortar was lifted in wheelbarrows and distributed directly where wanted.

There is a 3½-in. monolithic concrete top floor over

the entire building. For this work the aggregates were stored at a convenient place on the first floor, a portable mixer was placed near one of the hoists in such way that it would dump directly into a concrete buggy which remained on the hoist, then hoisted and delivered to the floor where wanted. These hoists were used by the night crew to lift the tile, conduit and all other material for the next day's run.

The elevator contractor used a gasoline hoist in one hatch for his equipment. The plumbing and heating contractor rigged an electric hoist in one of the air shafts which took care of all their material. There were three Skinner engines weighing 10 tons each unloaded on the first floor and lowered to sub-basement through one of the elevator hatches. All the plastering material was handled through the basement.

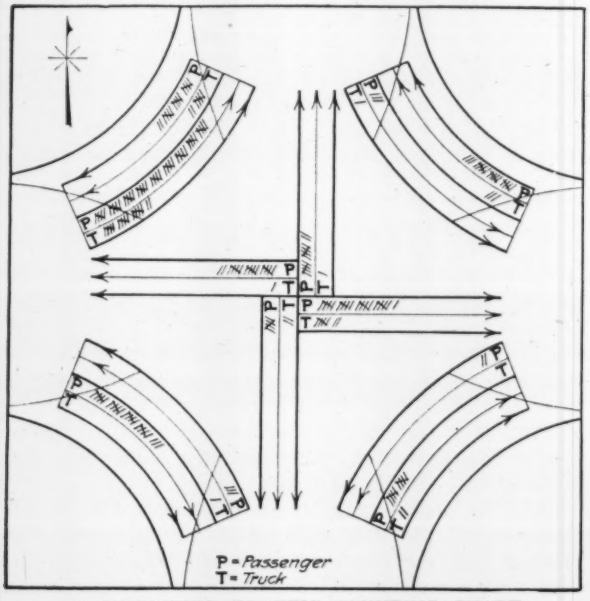
At times it taxed our limited storage space inside the building but we were able to keep everything entirely off the street and due to this fact the police and highway departments have given us every consideration.

Joseph F. Kuntz of Pittsburgh, Pa., was the architect. The writer represented both architect and owner on the job. Metzger, Fisher & White of Philadelphia were the general contractors with A. Erickson, superintendent.

A Self Reading Traffic Chart

By Jacob L. Crane, Jr.
Municipal Development Engineer, Chicago

FOR the purpose of expediting the registration of traffic counts at busy intersections a graphical chart is used. The advantage of the one shown lies in the



A SIMPLIFIED TRAFFIC COUNTING CHART

fact that the recorder jots down each vehicle showing graphically its origin and its direction of travel to and from the intersection. The chart gives the flow of traffic in both directions on all four streets and also the direction of the flow around the corners.

One recorder has taken a record on this chart of traffic running up to 1,000 machines an hour and two men can take a record of the busiest intersection encountered. To secure the same information on ordinary traffic counts charts would ordinarily require from four to sixteen men.

In the view herewith the count is an actual one taken at Lake Bluff, Ill., Green Bay and Scran... Sts. between 7 and 8 a.m., June 16, 1923.

From Job and Office

Hints that Cut Cost and Time

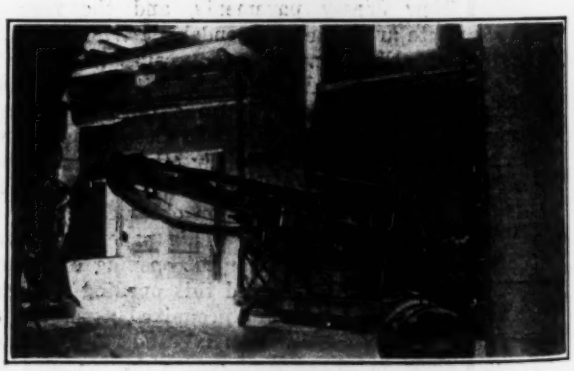
Spreading the Gospel of Traffic Safety

IN A recent county safety parade, the Wayne County (Michigan) Road Commissioners took advantage of the occasion to spread the gospel of traffic safety. The float herewith pictured shows the means used.

Box-Car Loader Made From Parts Obtained From Scrap Pile

A PIECE of equipment which has given efficient service was recently made by W. R. Hoback, engineer for the Gager Lime & Manufacturing Co., Sherwood, Tenn., entirely from parts obtained from the scrap pile excepting for the motor which drives it. It is a conveyor box-car loader used mainly for loading lime into box cars.

The machine is mounted on three casters, which makes it easy to move in any direction and in and out of the cars. The frame, which is of timber is 18 ft. long. On its under side, about 6 ft. from the lower end,



CONVEYOR LOADER MADE FROM SCRAP MATERIAL

From Job and Office

For Contractor and Engineer

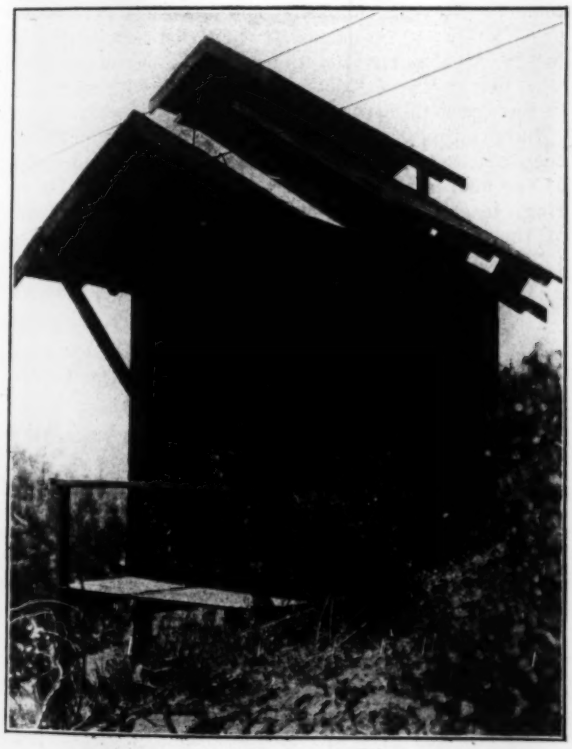
is mounted a 1⅞-in. shaft fitted with a 14-in. steel pulley having a face of 3 in. This is belt-driven direct from the motor's 4-in. pulley. The opposite end of the shaft is fitted with a 6-in. sprocket which is chain-connected to the head pulley at the upper end of the frame. Directly under the driving shaft is a steel support, made up of ½ x 3-in. flat bars. This takes care of the greater part of the loader's weight and also serves as a support for a pair of return idlers.

The belt was also taken from the scrap pile. It is 12 in. wide, lagged with 16-gage sheet iron turned up 4 in. at the sides, which prevents spillage and increases the carrying capacity.

The motor is of 2-hp. capacity. Current is supplied through one cable, of which there is sufficient surplus to permit moving the machine about. It will load 30 to 40 tons per hour. The machine is also adjustable as to height and lowering for different-sized cars.

Movie Machine to Make Continuous Construction Record

IN ORDER to obtain a practically continuous record of construction operations on a large western job a motor-operated moving picture machine was mounted in a small house at a point commanding a good view of the work. The mechanism was arranged for automatic operation except that the current was shut off at night.

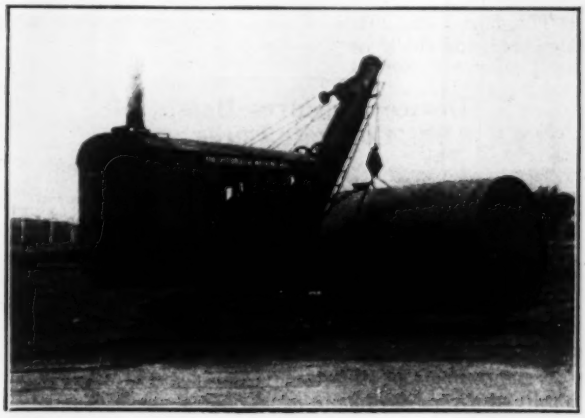


HOUSING FOR AUTOMATIC MOVIE CAMERA

Construction is designed to avoid excessive heat that might effect the film. Wires supply current for timing and cranking motors.

Two small motors were employed, one for operating a "contactor" or timing device, by which the second motor, which cranks the camera, was started and stopped. The contactor was designed to be adjusted for various speeds permitting a range from 2 min. to 2 hr. in the time between exposures. When the contactor mechanism closed the contact the cranking motor turned the camera crank 90 deg. which caused the camera to make two exposures or frames. The purpose in this plan was to provide a film, which when projected at the normal rate of 16 exposures a second, would show rapidly the sequence of operations throughout the entire construction period.

Steam Shovel Moves Steel Storage Tank



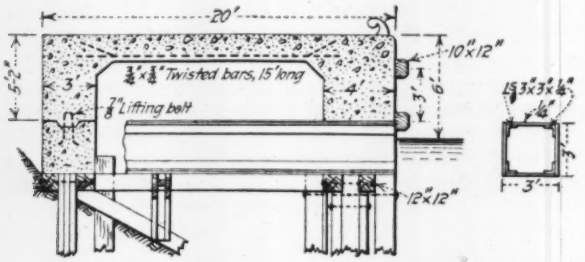
A GASOLINE filling station recently erected in the Middle West offered quite a problem to the contractor. The station was to be equipped with a 15,000-gal. steel storage tank, but since the station was about one quarter mile from the nearest railroad spur, the contractor was confronted with the necessity of finding some means of moving the tank that would be both cheap and quick. The size of the tank prohibited ordinary hauling as it weighed more than 5½ tons, and was about 25 ft. long and 9 ft. in diameter. Finally a nearby steam shovel was secured for the job. The dipper and dipper handle were removed and a chain cradle was placed around the tank and made fast to the sheave block. The shovel then easily lifted the tank clear of the ground and with a man walking at either end of the tank to prevent undue swinging, it was carried across a field about a quarter of a mile, and placed in a 12-ft. excavation. The continuous treads on the shovel made movement across lots possible with a considerable saving in time.

Sewer Outlet Through Concrete Dock

BY D. H. FLEMING
City Engineer, Owen Sound, Ontario

THE CITY of Owen Sound was recently confronted with the necessity of providing an outlet through the concrete deck of a government dock for a 36-in. concrete pipe sewer line. The substructure of the dock afforded no support for the concrete pipe, and the concrete deck presented construction obstacles. Decision was then made to remove sections from rear and front concrete blocks supporting the decking, and insert a steel flume, 3 ft. square.

Blocks were removed by drilling five or six holes almost half way through the concrete and in an almost horizontal plane. Drilling was done on the front face of the dock with a steam jack hammer operated from a raft; and the holes were kept clean by a ½-in. hose line from a city water tap. Holes were spaced so that they controlled an area 3x6 ft. in plan. They were then loaded with dynamite and shot, one or two holes



SECTION OF DOCK SHOWS FLUME INSTALLED

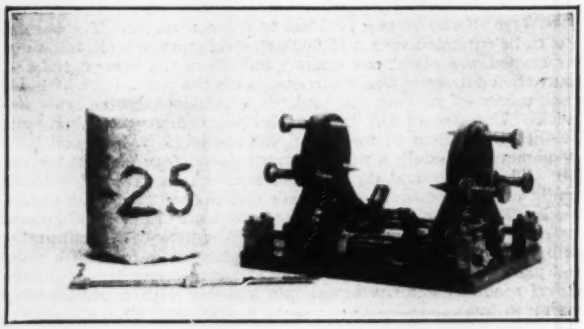
at a time, by an experienced man. In this way the block was shot clean and was easily removed. The steel flume was then inserted, forms were set and the other half of each block was repoured.

The flume was made of ¼-in. steel sheets with 3-in. angles ¼ in. thick at the corners.

Device Measures Height of Concrete Cores

BY G. W. HUTCHINSON
Assistant Engineer, North Carolina Highway Commission

THE testing of concrete cores drilled from finished pavements makes it necessary to have a suitable method by which the height of the specimen can be measured and proper correction ("Correction Data for Comparative Test Results from Field Specimens" *Proceedings*, American Concrete Institute, 1923) made for comparison of the test result secured with those obtained from specimens of standard size. Numerous



THREE-POINT DEVICE FOR MEASURING CORES

methods, including measurements by displacement and calipers, have been tried out by the Division of Tests and Investigations of the North Carolina Highway Commission, but the most satisfactory one consists of a three-point device shown in the accompanying photograph.

The use of this device allows consideration to be given to the irregularities of the top and bottom of the specimen when obtaining the average height. The core rests horizontally on two circular supports held by a pair of guide rods and which are adjustable according to the height of the core. At both ends of the device are the frames holding three screws which are brought in contact with the ends of the core for taking actual measurements. The frames are movable but can be held at convenient positions on the guide rods by means of thumb-set screws.

The core is placed on the supports and one frame brought into position to touch the end of the core. It is then clamped and held in that position. The other frame is moved into place with respect to the other end of the core and then clamped and its position marked by means of a sliding lug on one of the guides. The three screws in each frame are then manipulated until they just touch the ends of the core. When the core is to be removed, to allow the measurements to be taken, the second mentioned frame is unclamped and moved back and the core taken out. The frame is then moved forward into its original position in contact with the lug on the guide rod. The distance between the three opposite sets of screw points is then measured and the average of the three readings taken as the height of the core.

The average measurements of repeated operations check very closely when this method is used. The three points measured are equidistant from the center and outside of the core and also from each other.

From Job and Office

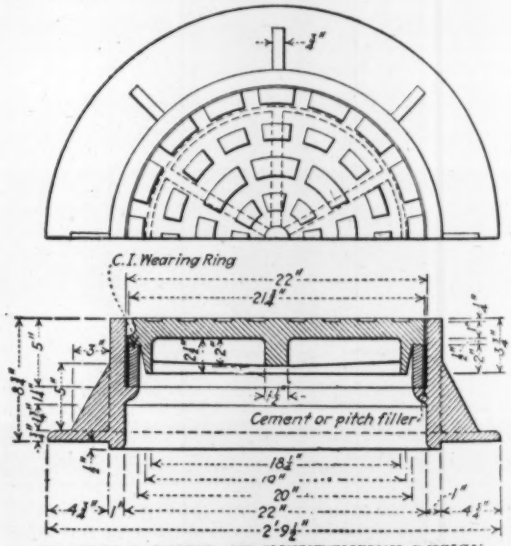
Hints that Cut Cost and Time

How Jacksonville Saved Money on Manhole-Cover Replacements

BY C. V. IMESON
Engineer of Sewers, Jacksonville, Florida

AN IMPROVED manhole cover designed to eliminate costly replacements of worn-out manhole covers in paved streets, brought out by the Sewer Department, Jacksonville, Florida, and adopted as standard, is shown in the accompanying drawing. A careful check of replacement costs has shown an average cost of approximately $50 for each job, which cost includes repairs to the street. The adoption of the cover shown herewith brings the cost down to about $6, with no repairs to the street necessary.

Barricading the street while repairs are made has been eliminated. About one and one-half hours' time of one man is all that is necessary to break out the old ring, insert the new one and place the filler back of the ring.



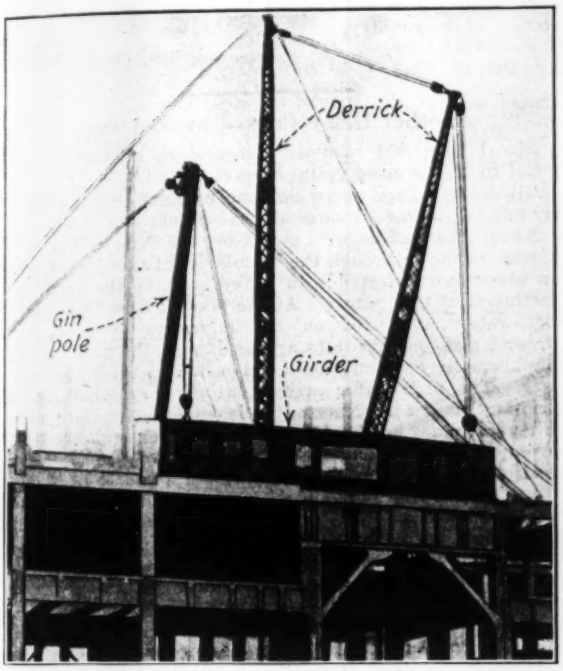
MANHOLE COVER OF INEXPENSIVE DESIGN

From Job and Office

For Contractor and Engineer

Derrick and Gin-Pole Lift Heavy Girder

IN PLACING a 68-ton plate girder 55 ft. long and 11½ ft. high at the fifth floor level of the Straus Building, Chicago, the load was divided equally between one of the two regular erection derricks and a special gin pole, each having a 100-hp. hoist. The guyed derrick which handled one end of the girder has a 123-ft. mast and 110-ft. boom, both of box lattice construction. The gin pole was a 50-ft. stick of Norway pine 20x20 in., guyed



ERECTING A 68-TON PLATE GIRDER

by six 1½-in. lines and having a set of blocks and tackle by which it could be boomed up in the same way as the derrick. The upper six-sheave hoisting block was slung from cable wrapping around the head of the pole.

Metal and Concrete Ties in India

Steel, cast-iron and concrete ties are used extensively on railways in India, besides various native and imported wood ties. The Northwestern Ry. is reported to have laid 1,200 miles of line with cast-iron plate ties in the past few years, while in 1922-1923 it laid about a hundred miles with the Stent concrete tie described in *Engineering News-Record*, Sept. 27, page 511. Steel trough ties are said to be in good condition after thirty years' service. It is thought they may be introduced again, although none have been purchased by this road for about twenty years. On the Great Indian Peninsula Ry., wood ties have been largely replaced with cast-iron pot ties. Both plate and pot ties consist of two separate cast-iron rail supports connected by a steel tie bar, and the Stent tie is an adaptation of the plate type in concrete construction.

Steady Output of 400 Cu.Yd. Per Day with a high mark of 600 cu.yd. has been attained in pouring concrete on the sewage disposal plant at Jones Island, Milwaukee, through efficient use and placement of concreting plant. All concrete is handled from a central plant and is chuted either from the hoist tower or a rehoist tower to all parts of the work, the ground plan of the structure being 650 x 750 ft., with the highest point of concrete averaging 20 ft. The central mixing plant includes two tilting mixers, two steel hoist towers, 216 ft. high with 1½ yd. capacity buckets. The towers are so arranged that power is supplied both hoists by a 100-hp. double-drum electric hoist. Aggregate is fed into the mixers from two overhead bins, each about 100-yd. capacity, these being fed by two 100-yd. per hour capacity bucket chain elevators. The entire bin feeding apparatus is electrically driven. A cement bin of about two-car capacity is located close to the bins, but is used for emergency storage only, a gravity trolley system of cement containers of the bottom-dump type, each of about 80 bags capacity, being constantly used to dispatch cement to the mixers direct from cement cars. The two main towers at the mixing plant supply one line of chutes 450 ft. long to a rehoist tower 196 ft. high. This rehoist tower in turn supplies a 120-ft. tower in the center of the job, which supports a line of chutes 280 ft. long on each side of the tower with a 50-ft. counterweight chute on each end, which is used to pour the circular tanks in the center of the job. A guy derrick of 10-ton capacity with a 115-ft. mast and 100-ft. boom supports the double counterweight chute system with total operating radius of 170 ft. This is placed in four different working setups and supplies concrete either direct from the two main hoist towers or from the rehoist tower. The mixers are operated alternately, and with specifications calling for 1½ min. mix have reached the maximum of 600 cu.yd. per day in a continuous pouring. The information herein was supplied by the T. L. Smith Co.

To Show in a Few Minutes the progress of work occupying several months, a series of moving pictures is being taken during the erection of the 32-story steel frame Straus Building at Chicago. In Grant Park, at a point opposite the new building, a wooden tower was built, with camera house having a tripod cemented to the floor and supporting the camera. Every morning, the photographer mounts the tower and runs a few feet of film. When the building is completed these strips will be run as a continuous picture.

Sinking a Shaft Through Rock will often uncover seams from which there is a considerable flow of water, causing discomfort to the workmen and poor results when placing the concrete lining. A method of taking care of this water was used in a rock shaft in New York City and is briefly outlined as follows: At the place in the rock where there is a considerable flow of water, two or three holes are drilled, in the same horizontal plane, a little below the outlet of the water. Into these holes are inserted square iron rods of sufficient length to project to within several inches of the form (when it is placed). These rods are then covered with sheet metal and the space between the rock and the sheet metal plugged with oakum, dipped in grout. A brick dam, about 5 in. wide and at least 6 in. high, is built in the approximate form of a segment of a circle, and a 1-in. pipe placed flush with the sheet metal and the inside face of the dam. The other end of this pipe is threaded and the pipe should be long enough to project well beyond the future inside surface of the concrete shaft lining. An elbow and a length of pipe can be screwed on this end and the pipe wedged with pieces of rock at the other end to reduce the strain on the pipe through the dam. This pipe will take care of the water during the drilling. After the shaft lining concrete has been poured, grout is forced into the pipe leading from the dam, and when sufficient time has elapsed this pipe is cut off flush with the shaft lining, the dam remaining embedded in the concrete. It was found that no leaks occurred in any of the shafts where this method was employed.—*Contractors Atlas.*

Letters to the Editor

This department aims to be a forum for the discussion of the views of engineers and contractors. The range of interest should be as wide as possible. Contributors are, therefore, asked to make their letters short.

In Defense of the Cement Supply Man

Sir—I read with great interest the letter of O. T. Reece, County Engineer, Neosho County, Kansas, in your issue of Oct. 4, 1923.

The profits of the building supply merchant are the subject of much speculation, agitation and misinformation. The impression Mr. Reece seeks to convey in regard to the distributor's profit on cement is too good to be true. The "tribute of twenty-five cents to sixty cents per barrel" needs explanation from Mr. Reece—explanation backed up by a detailed recital of circumstances surrounding it.

From a first hand knowledge of portland cement manufacturing and distribution, I question the accuracy of Mr. Reece's statement regarding the size of the tribute unless it was at a period when through the blundering shortsightedness of highway officials, road construction was delayed for cement, and stocks, bought at a premium, were diverted to save the same highway officials' faces.

Mr. Reece, like many others, is able to see only one side of the shield, unable to see that the economic distribution of any commodity cannot be planned and carried out on the basis of an individual operation. Mr. Reece can be assured of one thing. If it was not for the entire distribution system furnished by the construction material merchant, not only his county, but every farmer, builder and contractor in his county, would pay a good deal more for cement than they are at present doing.

The supply merchant offers to Mr. Reece and all county and state officials every facility for economic and even distribution of cement regularly throughout the year. That this offer is not taken advantage of is the reason for the roar that occasionally goes up from public officials.

The supply merchants of Neosho County, Kansas, are citizens and tax-payers, and Mr. Reece is the servant of citizens and tax-payers, so it is his duty to work with all, for the good of all; and while I do not personally know a single supply merchant in the locality presided over by Mr. Reece, yet I am sure they are just as willing to honestly and legitimately aid the county in its efforts to secure materials at a fair price as is Mr. Reece. E. K. CORMACK,

Detroit, Mich., Business Counselor,
Oct. 9, 1923. National Builders Supply Association.

Decomposed Rock Under New York City

Sir—In your issue of Sept. 27, 1923, an article discussing the rock foundation at the Public Library on 42nd St. raises some questions of the future decomposition of the bed rock in New York. There is an implied suggestion that since the surface rock at the site of the library shows some decomposition, such decomposition may be generally expected elsewhere in the town, with a resulting danger to foundations which may be based upon rock, now sound, that may in the future become weakened through surface decay.

Decay of the surface rock of the Manhattan schist series has been observed at a number of places on Manhattan Island and in Westchester County. In the excavations for the old subway in the 42nd St. neighborhood weak material near the surface was exposed in several places and removed in the process of excavation; the excavation of shaft 17 of the Catskill aqueduct, at 6th Ave. in Bryant Park, exposed disintegrated rock near the surface. Because of deep decay the Catskill aqueduct tunnel was located in some places 700 ft. below the surface.

It is undoubtedly true, however, in spite of such local occurrences, that the New York rock as a whole has been little affected by weathering since glacial time. The glacial markings on the rock surface so commonly observed on outcrops of the Manhattan series are the best evidence of the permanence and enduring character of the rock.

We are not even sure that the disintegration observed did not occur in pre-glacial time; it may be (and probably is) old rotten rock of pre-glacial origin not eroded by the continental ice advance. At the north approach of the Garrison tunnel of the Catskill aqueduct, near Garrison, N. Y., the excavation passed through about 600 ft. of rotten gneiss, undoubtedly a remnant of the original surface rock decayed in place, and not scraped away by the plowing action of the glacial ice. South of the glaciated boundary, the rock surface is covered by a mantle of disintegrated material, except where streams have removed it, but in the glaciated region such deposits are rare.

The New York rock is very old. There is no occasion to expect that it will change in the life of the structures based upon it. The city is fortunate in having as a foundation a rock which is as old and stable as can be found in any section of the country. JAMES F. SANBORN,

New York City, Consulting Engineer.
Oct. 13, 1923.

Another Delay Caused by Red Tape

Sir—I have just read with very much interest you editorial in *Engineering News-Record*, of Oct. 4, 1923, p. 540, entitled, "Red Tape and a Pontoon Bridge." This brings to my mind a similar instance of a few weeks ago.

About the middle of September the Nueces and Frio Rivers, running through the boundaries of this county, were up about thirty feet due to heavy rains to the north and northwest of this county. At the present time there are no high-water structures on the highways crossing these streams and concrete slabs are used, since the water is very low normally and only loose gravel makes the slabs necessary. The high water carried out three crossings on the Frio and one on the Nueces, the last mentioned being about thirty-five miles northwest of Uvalde and on highway No. 4, an important mail and freight route to the counties northwest of here which are not served with a railroad.

Just as soon as possible the author made a trip to this crossing and decided that a temporary affair made of sand bags would be the most economical crossing that could be built in the shortest possible time. Immediately upon returning to Uvalde, communication was obtained with the chief engineer officer at Ft. Sam Houston, requesting 500 sand bags. The author was informed that although plenty of sand bags were available, permission for their use would have to be obtained from the Secretary of War. A wire was sent the Secretary of War on Sept. 24 requesting permission to use 500 sand bags from the engineer warehouse at Ft. Sam Houston. On Sept. 26 a wire was received to the effect that the order had been referred to Ft. Sam Houston. On Sept. 28 a wire was received from Ft. Sam Houston to the effect that rice bags could be obtained from a Houston, Texas, firm for 5c. each, cheaper than the sand bags used by the army (so the wire stated), and requested the county to obtain the bags from this firm.

The reader will please bear in mind that this last wire was received four days after the first wire sent to the Secretary of War. In the meantime, fearing that the delay was becoming expensive and irritating to the public, cement sacks in sufficient quantity, but costing 10c. each, were obtained and the temporary crossing was built and was ready for traffic by the time the wire of the 28th was received.

This in the opinion of the author is just another case of where the army could have been of great assistance to a community with practically no expense and very little trouble. Just before this incident occurred, the author spent the greater part of two days assisting an army convoy, consisting of four heavy cars and five trucks, in finding a crossing over the Nueces River in order that they might reach Marfa, Texas, in time for maneuvres at that place. It is supposed that if this incident had not taken place, no answer at all to telegrams would have been received.

Uvalde, Texas, M. B. HODGES, County Engineer.
Oct. 9, 1923. Uvalde County, Texas.

News of the Week

CURRENT EVENTS IN THE CIVIL ENGINEERING AND CONTRACTING FIELDS

News Brevities

President Coolidge is Taking Up with the State Department, it is understood, the matter of calling an international conference to discuss oil pollution. It was stated at the White House that the President attaches much importance to this matter. It is expected that he will request active consideration of the entire subject in the hope that remedies may be attempted at the earliest possible moment.

The Governor of Hawaii Is En Route to Washington to take up with Federal authorities and members of Congress the matter of extending the Federal aid plan to the highways of that Island. Porto Rico has similar plans. Apparently highway officials of the various states have no objection to such extensions of the act since their organization recently has admitted to membership the highway commissions of those islands.

For the Purpose of Drafting a uniform building code for all future building construction in the national parks, the superintendents of the national parks of the United States will meet at Yellowstone Park the week beginning Oct. 22. By request of Secretary Work of the Interior Department to Secretary of Commerce Hoover, J. M. Gries, chief of the Bulding and Housing Division of the Department of Commerce, will attend the meeting.

A Proposed National Forestry Policy has been formulated by a special committee of the Chamber of Commerce of the United States (Washington, D. C.) and is being sent out for ballot to the 1,200 business organizations making up the membership of the Chamber. Among the eight items to be voted on are proposals for federal and municipal acquisition and planting of waste lands; for a national forest council; for a national survey and inventory of forest resources; for increased federal appropriations for the protection of timber lands against fire; and for an enlargement of federal forest research work.

A Committee on Russian Trade has been formed with Henry T. Hunt, former member of the Railroad Labor board, as chairman, and with headquarters at 120 Broadway, New York City. The committee will prepare an industrial report, investigations for which are being made by experts, including Valerian E. Greaves, a former professor of law in the University of Petrograd, and Ellery A. Baker, formerly in charge of the industrial department of the National City Bank, and will co-operate with export bodies and trade associations of American manufacturers to obtain credit insurance on shipments and to make arrangements for financing trade with Russia to make use of the extensive resources of the Russian Soviet Republic.

C. & N.W. Celebrates 75th Year

The 75th anniversary of the Chicago & Northwestern Ry. was observed Oct. 24 by ceremonies including a dinner to men who have been in the company's service for fifty years or more. From the first 10-mile line between Chicago and Maywood the system has grown to a total of some 10,000 miles extending into nine states.

Washouts on Government Railway in Alaska

A severe rainstorm combined with a high tide 6 ft. above any record level has put 100 miles of The Alaska R.R. out of commission, according to a telegraphic communication received by Secretary of the Interior Hubert Work from railroad officials at Anchorage, Alaska.

No estimate of the damage is furnished, but the entire section of the line between Seward and Potter has suffered from washed-out embankments and cave-ins on cuts. Two large bridges near Spencer Glacier and Bartlett Glacier have been washed away. The bridge destroyed at Spencer Glacier is a 120-ft. span.

Information is not full at this time, but it is believed the line can be reopened within two weeks, was the report from Alaska.

British Claim Damages on Rio Grande Reclamation Project

The American and British Claims Arbitration, an international tribunal, will hold a hearing in London on Nov. 5 to consider claims growing out of the construction of the Rio Grande reclamation project in Texas and Mexico by the Reclamation Bureau of the Interior Department.

The claims, ranging from $3,000,000 to $5,000,000, represent alleged damages suffered by British capitalists, who attempted to develop irrigation along the Rio Grande River in Texas and Mexico some years before the American government took up the project. Later, after its construction by the United States, the British capitalists charged that the Reclamation Service of the United States was responsible for their failure and had wrongfully deprived them of their rights.

The State Department represents the United States in denying the equity of the claims and at the hearing will present written briefs and arguments against granting them. Sir William Willcocks, a British irrigation engineer, is expected to give oral testimony in behalf of the British subjects.

Arthur P. Davis, recently dismissed, by Secretary of Interior Work as Director of the Reclamation Service, has sailed at the request of Secretary of State Hughes to aid in presenting the case of the United States.

Am. Soc. C. E. Fall Meeting in Virginia

Main Meeting at Richmond With Boat Trip to Hampton Roads and Washington

Engineering News-Record Staff Report

Excellent attendance and increased interest in the technical sessions marked the fall meeting of the American Society of Civil Engineers which was held Oct. 17-20 between Richmond, Va., the Hampton Roads district, and Washington, D. C. Just before the end of the meeting it was announced that 471 had registered, which included a greater proportion of non-residents as usual, and nearly 200 took the two-day boat ride which included stops at William and Mary College, at various places in the Hampton Roads district, and ended in Washington, where trips were made to the Arlington experimental farm of the Bureau of Public Roads and around the city of Washington. Entertainment included a Southern buffet dinner, entertainment and dance in Richmond, automobile trips around the city of Richmond, and a luncheon by the Washington Section on the final day.

No business was transacted, except the unanimous and enthusiastic endorsement of the letter which the Board of Direction had prepared to send to Dr. Hubert Work, Secretary of the Interior, in answer to his earlier letter explaining or attempting to explain his action in dismissing Arthur P. Davis from the Reclamation Service. This letter is printed in another column. Announcement was also made of the award of prizes noted in this journal last week.

Technical Sessions

The technical sessions comprised two morning general meetings, the first devoted to highways and the second to the port problems of Hampton Roads, and a simultaneous afternoon session of, in one room, the power division, and, in another room, the highway division. All were very well attended, and while there was not time for much voluntary discussion there had been arranged a more than usual amount of discussion which illuminated the general subjects treated.

The main paper in the road session was entitled "Fundamental Principles of Highway Financing," by Thomas H. MacDonald, chief of the Bureau of Public Roads. Mr. MacDonald prefaced his remarks by stating that it is time that people be made to understand that the engineer is to be trusted in matters of finance, particularly in financial policies for such matters as road building. In this, he explained, engineers were much more sound than the banker. He said a financial policy for road building must be based on the earning capacity of the highways and requires an examination in each locality before a policy is outlined. This examination should discover the saving in the cost of maintenance and operation of the vehicle, the earnings due to increased value of prop-

erty served, the earnings due to the time saved, all of which means that the benefits to society, to industry including agriculture, and to the road users must be analyzed. The extent of the improvements planned as necessary should not be in excess of an earning capacity. He said that there has been in no state a successful pay-as-you-go policy, and that there must be authority for taxes to support the bonds which ought to go only for permanent improvements, the motor tax to go for maintenance alone.

Highway Sessions

George E. Hamlin, superintendent of repairs of the State Highway Commission of Connecticut, and J. S. Mackay, chief, Division of Highway Economics and Transport of the Bureau of Public Roads, both discussed, under the head "Road Service in Industrial Regions," the results of the well-known Connecticut traffic survey which is just completing its first year. They repeated the figures regarding the first three months of this survey, which have already been published, and indicated that much valuable material is to come from the whole year's survey. Mr. Hamlin, in addition, called attention to some of the necessities for a road service in an industrial region. He noted the fact that there must be markers to speed up traffic and that the numbering system of roads must be elaborated. He called attention to the fact that the whole New England States system had agreed now on a single system of numbering so that the tourist could follow a road through all of the states. He emphasized the necessity for policing roads. A certain amount of traffic increase can be expected by such methods, but, after all, in the East roads are rapidly becoming saturated and the only solution is to widen or parallel. We must expect new trunk lines for fast and safe traffic. Continuity of service is demanded, and as a part of this snow removal is a necessity in the North. One tractor with a plow can open 10 miles of highway in Connecticut; 1,500 miles of highway were kept open for $175,000 last year—$120 per mile under very extreme conditions.

Prof. Mackay emphasized the necessity for traffic surveys and called attention to the Connecticut, the California, and the Tennessee work, and stated that Pennsylvania is to start this month on one of the most elaborate surveys ever undertaken. He said that the field for motor transportation in the future is (1) urban motor truck transportation in congested areas; (2) organization of motor freight service to supplement and extend the present service of rail and waterway; (3) short-haul zone of freight under 30 miles, non-competitive service; (4) transportation of a limited number of small commodities, where delivery time and cost of goods are important factors. He does not believe that there is any danger of competition with the more established freight services, but that special fields are bound to develop.

In the highway division special sectional meeting, C. M. Upham, chief engineer of the North Carolina State Highway Commission, described the new development of the system in his state, and the work was commented on by Clifford Older, of the Illinois Highway Department, and George H. Biles, formerly commissioner of highways of Pennsylvania. In the power division, W. S. Lee, chief engineer of the Southern Power Co. and the Quebec Development Co., outlined the developments of the Southern Appalachian power system. He called attention to the fact that in the southern district superpower was already in operation, but that it was of a different type than in any other part of the country. Here they have no large blocks of power and they do not send the power long distances, but the various companies are tied together over an extended area and the interconnection consists in the repeated transfer of power from one to the next adjoining district. In effect, this constitutes the transfer of power over the whole area. He also showed motion pictures of the construction of several of the large power plants in the South.

Thursday morning's session was devoted to a categorical description of the port problem of the Hampton Roads district and to the showing of some motion pictures by A. T. Goldbeck, of the Bureau of Public Roads, on the operation of the road testing work at the Arlington farms, outside of Washington.

In addition to the foregoing meetings, there was an informal conference of representatives of the local section held one afternoon.

Illinois Central R.R. to Start Electrification in Chicago

The Illinois Central R. R. Co. has applied to the Interstate Commerce Commission for permission to issue preferred stock not to exceed $12,022,450 par value and $12,022,450 of common stock. The latter is to be issued from time to time at the request of the holders of preferred stock and to be exchanged share for share for that stock.

The funds thus secured are to be applied upon the electrification of the company's lines within the city of Chicago.

In its statement to the Interstate Commerce Commission, the Illinois Central estimates that the work ultimately will cost $88,801,562. Eighteen years will be required to complete the work, it is estimated.

Prof. Wagner New President of Rose Polytechnic Institute

Frank C. Wagner, for twenty-eight years a professor of engineering at Rose Polytechnic Institute at Terre Haute, Ind., and acting president since the resignation of Dr. Philip B. Woodward last May, has been elected president of the school. Professor Wagner graduated from the University of Michigan in 1883 with an A. M. degree and also the degree of mechanical engineer. He was an instructor in the engineering school at the University of Michigan at two different periods, between which he was sent to Mexico by the Thompson-Houston Electric Co. of Lynn, Mass., for whom he did engineering construction in Mexico City and built a street lighting plant in Pueblo.

The school was recently moved from within the city of Terre Haute to a new building and extensive grounds in the open country near the city (see *Engineering News-Record*, Aug. 30, p. 351.)

Am. Soc. C. E. Convention Condemns Dr. Work

Protest Sent Secretary for Summary Removal of A. P. Davis and Implied Slander of Engineers

After a detailed investigation of the action of Secretary of Interior Work in dismissing A. P. Davis from the position of Director of the Reclamation Service, the American Society of Civil Engineers, in an open session at the fall meeting of the society at Richmond last week adopted the recommendation of the Board of Direction that a condemnatory letter of Dr. Work's action be dispatched him immediately. The letter offers a vigorous protest of the Secretary's action and his slanderous implication that engineers are not possessed of the highest business qualifications. The letter, which was sent Dr. Work Oct. 17, follows:

"Your courteous reply of Aug. 14 to our inquiry of June 27 has been very carefully considered, and the whole matter of your dismissal of Director A. P. Davis of the Reclamation Service has been investigated by this Board, aided by a special committee of two fair-minded engineers, widely experienced in public service and business affairs, one of whom is an honorary member and the other a past-president of this society.

"We regret to have to state that after mature deliberation we feel constrained to protest against your action with the utmost vigor.

"1—Because the dismissal, made so suddenly and but little over three months after you became secretary, was arbitrary, and was unjust to a highly efficient and experienced public official, a most eminent civil engineer, of long recognized national and international standing in his profession, whose high qualifications you yourself have certified by offering to make him consulting engineer of the Reclamation Service.

"2—Because the action necessarily must undermine the morale and loyalty of the whole Reclamation Service, tending to substitute political standing for merit, and leading to the danger that the public funds may be wasted through inefficiency. Similar action applied to other technical bureaus would demoralize the entire technical and scientific service of the government.

"3—Because the action was taken by the device of nominally abolishing the position and immediately creating its equivalent under another name, a subterfuge which, as we are informed, it has been attempted to legalize by an ex-post facto executive order. Furthermore, the charge repeatedly has been made in the press, and without denial by you, that your offer to retain Mr. Davis as consulting engineer of the Reclamation Service was on condition that he omit to state that his resignation was requested by you. Of this fact your letter contained no reference.

Effect of Work's Action

"4—Because there is great danger that the effect of your action eventually may lead to the waste of vast sums of public funds to meet political demands put forward on behalf of selfish private interests. Disagreeing entirely with your views, we consider it established that efficient technical bureaus, such as the Reclamation Service in the past

(with its world-wide recognition as a model for other nations) can meet all the just needs of the government irrigation projects. Farmers generally throughout the United States are suffering under present conditions no less than those on reclamation projects.

"Engineering ability and experience are essential to the direction of the management no less than to the building of the reclamation projects.

"5—Because business and engineering ability both are necessary qualifications for the efficient discharge of the duties of the Director of the Reclamation Service, or, as now called, the Commissioner of Reclamation.

"Indeed, the whole engineering profession resents most strongly the slander (implied in your letter) that engineers cannot, or at least do not possess business qualifications of the highest order. In transportation, in mining, mechanical, electrical and other great industries, engineering executives play a most important part. Engineers are presidents of the Pennsylvania R.R., the New Haven, the Delaware & Hudson, the Chicago & Northwestern, the Santa Fé, the Great Northern, the Chicago & Great Western, and many others. Both presidents of our two big electrical companies are engineers; many of our large industrial and manufacturing operators are headed by engineers; in fact, engineers play important parts in business affairs in the long list of human activities in the United States. The fact that hundreds of thousands of Americans are content to trust investments of billions of dollars to the hands of engineers is ample proof—if any be needed—of the falsity of the charge that engineers are not business men.

"Your explanation, therefore, is inadequate in every respect. Your action is of a character most dangerous as well as unjust. We protest it in the strongest terms.

"The Board of Direction of the American Society of Civil Engineers.

"By C. F. LOWETH, President.
"JOHN H. DUNLAP, Secretary."

More Power to Be Developed at Stave Lake, B. C.

Work has been started recently by the British Columbia Electric Company on a plant to develop more power at Stave Lake on the properties acquired from the Western Canada Power Co. A total of 157,000 hp., it is estimated, may be added to the present output and it is intended that this shall be developed in three separate units as the market may require.

The first development will be a 25,000 hp. addition to the present Stave Falls plant and will be located in a separate structure to be erected near by and operated by the same crew as the present plant aided with remote control apparatus. The second plant will be located on the upper end of Stave Lake and will be supplied with water from Alouette Lakes by the aid of a dam on that lake and a 3,900-ft. tunnel. This plant will utilize a drop of about 140 ft. and will develop 12,000 hp. The third plant will have a capacity of 120,000 hp. and will be located about 3½ miles down the river from the present power house.

Illinois Nears 1,000 Miles Record of Hard Roads in Year

Illinois' goal of 1,000 mi. of hard road before the close of 1923 seems within reach. The State Division of Highways announced on Oct. 15 that 906.42 mi. had been completed and that with favorable weather for the next five or six weeks the thousand-mile mark should be reached. During the week ending Oct. 11 a new week's record was set with 51.21 mi. The report shows there are now 118 mixers, 9,600 men and 2,200 teams employed in building new roads for Illinois. Last year Illinois set a record of 722 mi. of hard roads.

To Form Joint Committee on Structural Safety

In order to carry on the work inaugurated by its committee on structural safety, the New York Section of the American Society of Civil Engineers at a meeting held on Oct. 17, to which it had invited representatives of the architects and builders, resolved to ask the local architectural societies to co-operate with it in the formation of a joint committee to consider the whole subject and make recommendations to their respective societies. The adoption of this resolution followed an animated discussion of the report of the section's committee on structural safety in which the fact was brought out that, although there is some divergence of views as to the architect's or engineer's responsibility for the execution of his design, the architects and engineers agree that until there has been a radical change in the present methods of building which will result in none but competent builders being allowed to undertake any work, laws or changes in building codes will be of little value. Both sides feel that it is necessary that they should co-operate to arouse public opinion to the necessity of putting a stop to construction by irresponsible builders.

For Reference—New York Subway Articles Reprinted

Realizing the importance, for reference purposes, of a complete description of all engineering features of New York City's rapid transit system, *Engineering News*, in 1914, engaged Fred Lavis, consulting engineer, with a long experience in railroad and general construction work, to prepare a series of articles on this subject. These articles were published beginning Oct. 1, 1914, and in response to numerous requests they were reprinted in book form. A recent examination of our stock-room showed that 150 copies of this book are still available for distribution, and while the supply lasts they will be sent to any *Engineering News-Record* reader on receipt of 25c. to cover postage and handling charges.

The book consists of 73 pp. (9x12 in. in size) profusely illustrated with photographs and drawings. The text covers such subjects as history and extent of rapid transit in New York, organization of engineering staff, construction arrangements and operating contracts, superstructure and track, ventilation, drainage and waterproofing, subsurface structures, timbering, excavation, underpinning, tunnels and concrete work. The final chapter is on elevated railways.

A.A.E. Board of Directors Re-elects Drayer

Resolution Also Adopted Protesting Against Dismissal of Davis by Work

At the quarterly meeting of the board of directors of the American Association of Engineers, Oct. 4, 5 and 6, C. E. Drayer was unanimously re-elected secretary and H. W. Clausen re-elected as treasurer.

Other action of the board follows:

The conventions committee's report on San Francisco as the next place of meeting was accepted. The date is not set but will be after June 10, 1924. A resolution of protest on the dismissal of A. P. Davis as director of the U. S. Reclamation Service was directed to the Secretary of the Interior. The annual publicity contest by chapters will be held under the same rules as in the past. It starts Nov. 1 and ends May 15. Felicitations were extended by resolution to the President of Mexico on recognition of his country and a formal resolution will be directed to the engineers of Japan expressing the feelings of American engineers on the recent earthquake disaster. Owing to the appointment of Dr. F. H. Newell as consulting engineer of the Pennsylvania Giant Power Survey he has had to be released as field secretary.

DAVIS RESOLUTION

The Davis resolution reads as follows:

"Whereas, Arthur P. Davis, Director of the U. S. Reclamation Service, was recently removed from the office that is believed he has filled honorably and efficiently; and

"Whereas, the U. S. Reclamation Service investigates the feasibility and practicability of engineering works, and engages in the design, construction and maintenance of such works; and

"Whereas, under the direction of technically trained heads the service has for a long time been free from all suggestion of political interference, improper conduct, or inefficiency; and

"Whereas, it should be evident that all engineering and technical divisions of the Government should be free from political interference, and that engineers or technically trained men should be able to administer them with peculiar effectiveness;

"Be it resolved by the Board of Directors of the American Association of Engineers in regular meeting assembled that it strongly deprecates the replacement of an able and faithful engineer by a politician under the plea that a "business man" can serve more effectively than an engineer as head of the Reclamation Service; that it deplores the woeful ignorance of facts indicated when it is implied that an engineer is incapable of exercising business judgment equal or superior to that possessed by the follower of any other profession or calling; that it vigorously protests against the injection of politics into the affairs of one of our Government's most important technical divisions; that it requests and urges that the next Congress institute a rigid public investigation of the removal of an engineer and the appointment of a non-technical man to head the U. S. Reclamation Service; and that copies of this resolution be sent to the Secretary of the Interior of the United States and furnished to the press."

Work Addresses Reclamation Fact-Finding Body

Starts Committee on Investigation of U. S. Reclamation Service After Substituting Bureau

The following statement was made by Secretary of the Interior Work Oct. 15, at Washington, D. C., at the opening meeting of the Fact-Finding Committee to investigate government reclamation methods:

"Soon after I was called upon to act as Secretary of the Interior, in March, 1923, my attention was particularly directed to conditions relating to the reclamation projects constructed or being constructed by the department in the western states, among which I have lived for thirty-five years.

"Through complaints from organizations of water users, individual water users, reports of agents, inspectors, official records of the department and Congress, it appeared that nearly all of the projects were in such condition that some radical reforms or improvements must be had if they were to be saved, farmers protected from loss of their homes, and the return of the money advanced by the government for their construction and maintenance was to be secured.

COMPLAINTS AND CRITICISM

"The complaints and criticisms cover a variety of points, too numberous to be described here, but included charges that in many of the projects the original estimates under which settlers were induced to go upon the projects were from 50 to 100 per cent too low, and that the actual cost has been so great that it is impossible for the farmers to pay out within the time and manner fixed by law, or even at all; that mistakes, engineering and otherwise, had been made which added materially to the cost of constructed projects; that others had been undertaken that should never have been started; that the overhead costs of the service and many of the individual projects, all borne by water users, were burdensome and excessive.

"Under the system used in the Reclamation Service I have been unable to get figures that appear to be dependable as to the cost of individual projects or the total money expended on all projects. It is represented, taken from the records of the bureau, that the government's total investment to June 30, 1923, in round numbers is $181,000,000, and its total receipts about $46,000,000, leaving a balance invested and unpaid of $135,000,000.

"The Reclamation Service, for which this department is responsible, apparently requires reorganization. Annual reports on some projects indicate their insolvency and pending failure. Out of the 28 projects only one has met its obligations as they fell due. Long extensions of time for payments due are being urged individually and by projects. The original twenty-year period for payment is expiring on certain projects and an additional twenty-year extension is being asked. In one instance, such extension is to be preceded by a five-year moratorium.

"Reclamation of arid lands by irrigation from government funds, as heretofore practiced, is failing on a majority of projects as a business procedure and must be promptly readjusted as to methods of reimbursement for funds appropriated and for the purpose of securing to the settler a permanent home.

"Your committee is requested to survey the whole subject in its entirety, and give to the bureau your opinions concerning our operating methods that we may avoid errors, and finally your recommendations which Congress may study and which should ultimately preserve the sanctity of contract, secure to farmers safety for their investments already made and insure a return of invested funds. I want to improve and extend the service in every way possible, and solicit your suggestions and recommendations.

"Government reclamation has accomplished much. There is a great field for its future. Reclamation in the West by private enterprise was begun thirty years before the government began this work and has largely redeemed the West. Government reclamation should make a comparable showing, relieved as it is, from interest charges, which is the basis of calculation in all enterprises employing private capital. I am anxious that a policy may be developed that will safeguard the future of government reclamation which is my only cerncern in this inquiry."

Portland Lets Pipe-Line Contract for $2,571,403

A contract for the laying of Bull Run water-supply line, conduit No. 3, has been awarded by Portland, Oregon, to the Willamette Iron & Steel Works of that city, at $2,571,403 for lock-bar steel pipe. The total length of this line is 132,000 ft. of which 52,400 ft. will be 58 in. and 80,000 ft. 50 in. in diameter. Under arrangements made by the successful bidder with the East Jersey Pipe Co. the plates will be shipped from Leetsdale, Pa., in a partially fabricated condition and the Willamette company will complete the operations of rolling, pressing, testing and dipping at their Portland plant. It is expected that this arrangement will be conducive to the placing of additional lock-bar pipe on the Pacific Coast. The Portland contract is the result of alternative bids asked on either lock-bar or riveted steel pipe. Other bids were as follows:

	Lock-Bar	Riveted
J. H. Tillman Co.	$3,032,135	$2,628,645
F. J. Shea	.....	2,647,161
T. A. Gillespie Co.	2,696,090	.....
Western Pipe & Steel Works, of California	.....	2,708,381
Lyon S. Atkinson, Jr., Los Angeles	.....	3,093,367

Fred M. Randlett is chief engineer of the Portland Water Bureau.

New Quebec Power Project Begun

The Laurentian Hydro-Electric, Ltd., has completed its financial arrangements and begun construction work for the development of power on the North River, Quebec. It has a franchise for ten years to supply light and power to the towns of St. Jerome, St. Adele, Strawbridge, Val Morin and other places in the Laurentian district. William Kennedy, Jr., and E. W. Loignon are retained as engineers and will supervise the construction of the plant.

Random [illegible]

A Super-Literary A[illegible]sion

Sir—To show that [illegible] of the term "engineer" by pr[illegible] hardly deserving that title is [illegible]ined to our own country, I cop[illegible] following from "The Unsocial So[illegible] written by George Bernard Shaw [illegible] forty years ago:

"JEFFERSON SMI[illegible]SH
Painter, Decorator, Glazier, Plumber & Gardener.
Pianofortes tuned. *Domestic Engineering* in all its Branches.
Families waited upon at table or otherwise.
Chamounix Villa,
(N. B.—Advice Gratis. Lyvern.
No reasonable offer refused.)"

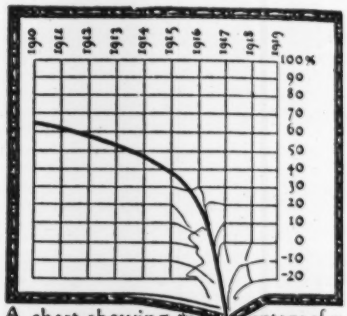
D. C. K.

—"Work wanted by *Practical Heating Engineer*—caring for furnaces."—Advertisement in daily paper.

—"Planning French Hat's an Engineering Feat—They make a regular survey and every cranial bump and depression counts."—Headline in Albany *Times-Union*.

* * *

The New York *Evening Post* in the accompanying chart introduces a new idea in plotting progress. Something might be done with it in tracing the productivity of bricklayers or—at the upper end of the scale—with the cost of construction.



A chart showing the percentage of excellence in the physical properties of books published since 1910.

* * *

There Are Advantages

From The Complete Amorist: "A hair-net is a thing that gets caught in the buckle of a wrist-watch." A hair-net, in the brave old military days, was a thing that used to get caught on the collar insignia. Hundreds of officers, we have been told, got themselves transferred from the Infantry to the Engineers for no other reason, F. P. A. in the New York *World*.

* * *

Moving Sidewalks?

"We are not so much advertising men as Sales Engineers. Seeking and exploring through science avenues to the human mind that will move it to action in the supplying of needs; in the creation of wants."—From the advertisement of a Pittsburgh printer.

Cement Manufacturers Protective Association Ordered Dissolved

By an order handed down on Oct. 23 the Cement Manufacturers' Protective Association, a trade organization comprising 19 of the largest cement makers of the Lehigh and Hudson River districts, was ordered dissolved by Federal Judge Knox, New York City. Thus disposition is made of the equity case against the defendant organization, a case filed at the same time in 1921 when criminal indictments were returned against many of the association's members and officials of the member companies.

The criminal trial was held last year but ended in a jury disagreement. At that time it was agreed that all of the evidence adduced during the criminal proceedings should be the basis of any action in the equity case.

The Cement Manufacturers' Protective Association has not been functioning, except superficially, for a year.

War Camp Suits Must Give Bill of Particulars

In an opinion handed down by Federal Judge John E. Sater in the case of the government against the A. Bentley & Sons Co. of Toledo, Ohio, the builders of Camp Sherman, Judge Sater upheld the motion of the defendant that the government submit a bill of particulars as to the fraud with which the contractor is charged. Judge Sater ruled that the defendant company is entitled to such reasonable particulars as will indicate upon what evidence is to be given, namely, as to what materials or what quantity of the same were wasted, as to wherein the defendant purchased and resold at a profit materials and equipment needed and not needed.

The court also ruled that as the petition charged fraud, it should show with reasonable certainty of what the fraud consists, how it escaped detection by the government officer in charge, and why it was not detected at the time of its perpetration or for so long a time thereafter; that the petition should show that the plaintiff did not consent or was ignorant of the subletting of portions of the work to various subcontractors. The judge also ruled that the averment about the patriotism of the persons and concerns intrusted with the performance of emergency work should be omitted, as there is nothing in the contract which indicates that patriotism was any part of the consideration.

In regard to the government's claim that the contractor in operating on a cost-plus contract was in the position of a trustee of the government Judge Sater stated that the claim is not sustained in law, that when the government enters into a contract with an individual or corporation it divests itself of its sovereign character as to that particular transaction and takes that of an ordinary citizen and submits to the same law as governs individuals under like circumstances. He upheld the claim of the government that under the contract it had a right to make a deliberate review of the payments made the contractor in order to correct mistakes which arose due to the urgency of making prompt payment, but he stipulated that if the government has, as it claims, found that the contractor defrauded it of $5,000,000 the defendant contractor is entitled to particulars.

Engineering Societies

Calendar

Annual Meetings

AMERICAN SOCIETY FOR MUNICIPAL IMPROVEMENTS, St. Petersburg, Fla.; Annual Convention, Atlanta, Ga., Nov. 12-16.

CITY MANAGERS ASSOCIATION, Lawrence, Kansas; Annual Meeting, Washington, D. C., Nov. 13-15.

AMERICAN ROADBUILDERS' ASSOCIATION, New York City; Annual Convention, Chicago, Jan. 14-18.

AMERICAN SOCIETY OF CIVIL ENGINEERS, New York City; Annual Meeting, New York, Jan. 16, 17.

AMERICAN CONCRETE INSTITUTE, Detroit, Mich. Annual meeting (20th anniversary), Chicago, Ill., Feb. 25-28, 1924.

The Brooklyn Engineers' Club on Nov. 8 will have for special feature a paper, with lantern slides, "Arching Effect in Soil," by Emil Bie, engineer of the New York Board of Estimate.

The North Carolina Section of the American Water Works Association will meet in New Bern, N. C., Nov. 13-15, and discuss papers on metering, fire protection, algae in water supplies, streamflow records, filter operation and direct-oxidation.

The Four-States Section, American Water Works Association, had a luncheon at the Engineers Club, Philadelphia, preceding the conference on water pollution held at the same place on Oct. 16, and reported elsewhere in this issue. About 70 members were present. George W. Fuller, president of the association, called attention to new constitutional provisions under which there will be nine geographical sections instead of the present six, thus making feasible the creation of a Canadian section, whereas heretofore the Canadian provinces have been included with several American states in a section. To avoid confusion the term "division" instead of "section" will be applied to the Chemical and Bacteriological Section and any other technical sections that may hereafter be formed.

Personal Notes

F. C. MAGRUDER has accepted a position as city engineer of Enid, Okla., which city plans to spend a million dollars next year in construction work for an additional water supply.

ADAMS & ADAMS, consulting engineers, Detroit, is the new firm name of William H. Adams and his brother, Ralph W. Adams, whose recent admission to partnership with him is announced. The offices of the firm are in the Campau Bldg., Detroit, and they will practice in general construction engineering.

KENNETH M. CAMERON, assistant chief engineer of the Department of Public Works of Canada since 1918, has been appointed chief engineer of that department succeeding the late Arthur St. Laurent. Mr. Cameron is a graduate of and has a master's degree in hydraulics from McGill University. He had early railroad experience in the office of the chief engineer of the Canadian Pacific Ry., was inspection engineer of the Canadian Niagara Power Co., for some time was with Smith, Kerry and Chace, consulting engineers of Toronto, and in the Public Works Department was located successively at London, Sherbrooke, and at Ottawa in the dredging branch.

DANIEL C. COOPER, formerly construction superintendent with the United States Gypsum Co., at its Oakfield, N. Y., and Lancaster, Ohio, plants, is now connected with the Power Corp. of New York, Watertown, N. Y., as construction engineer.

EARL PHILLIPS, city engineer of Peru, Ind., has resigned and the appointment of PAUL SHADINGER to fill out the unexpired term is announced.

JOHN E. ALLEN, formerly with William Steele & Sons, of Philadelphia, as concrete engineer, is now engineer in the structural division of Stone & Webster, Inc., Boston, Mass.

A. D. MCLARTY, Urbana, Ill., has been appointed secretary of the Illinois Municipal League, and will give all his time to this work. He succeeds Prof. R. M. Story, who has resigned.

E. C. LAWTON, who has been made a highway research specialist in the Bureau of Public Roads, Washington, D. C., formerly was assistant engineer of construction on main highway work at Buffalo, N. Y., for the New York State Commission of Highways.

G. W. FLEMING, formerly assistant structural engineer with the Leonard Construction Co., Chicago, Ill., is now doing similar work with the George F. Hart Engineering Corp. and is located in Brooklyn, N. Y.

M. F. LONGWILL, division engineer of the Detroit division of the Wabash R.R., with headquarters at Montpelier, Ohio, has been promoted to assistant chief engineer of the eastern district of the Wabash lines, with headquarters at St. Louis, Mo. Mr. Longwill is a graduate of Ohio Northern University. He has held various positions with the Missouri Pacific Ry. and the Union Ry. of Memphis, and has been with the Wabash lines since 1918.

GEORGE D. FAIRTACE, recently city engineer of Dallas, Texas, has been appointed city manager and engineer of Highland Park, Texas.

J. D. TRAMMEL, recently chief engineer of the Spavinaw water supply project at Tulsa, Okla., in which were constructed at a cost of $6,800,000 a dam and a 61-mi. pipe line, has opened offices at Ft. Worth, Texas., in the Waggoner Bldg., and will conduct a consulting practice.

T. H. DILLON, of the firm of Titus & Dillon, engineers, and at present county engineer of Shelby County, Texas, has been appointed also engineer on the highway work of Panola County, Texas.

JOSEPH GRESHAM, formerly county engineer of Mason County, Texas, and S. A. DIETZ, formerly engineer for Hidalgo County, have been appointed assistant county engineers of Jim Wells County, Texas, under County Engineer L. W. S. MANTELL, at Alice, Texas.

Obituary

FREDERICK T. BAGSHAWE, civil engineer, died recently in Winnipeg, where he had resided for many years. He was born in England where he received his education, and was engaged in railway construction there and in Australia before going to Canada, where he has been in charge of several civic undertakings and has superintended bridge and track construction for the Canadian Northern Ry.

WILLIAM G. BLIGH, for many years executive engineer of the Public Works Department of India but more recently a resident of Toronto, Canada, died Oct. 16 in Calgary, Alta., aged 77 years. Mr. Bligh designed and constructed some of the largest irrigation works in India and Burma, and his book, "Practical Design of Irrigation Works," is a recognized text book on the subject.

GENERAL EDMUND HAYES, engineer and formerly chief of the staff of engineers for the state of New York, died Oct. 19 at his home in Buffalo, N. Y., from a stroke of appoplexy at the age of 74 years. He was born in Farmington, Me., and attended Dartmouth College two years and graduated from the Massachusetts Institute of Technology. In 1874, becoming associated with General Field, at Buffalo, he entered the business of the Morrison & Field Bridge Co., later the Central Bridge Co., and was engaged in many projects during the period of railroad expansion of the 70's. After this firm sold to the United States Steel Corp., General Hayes became interested in the Ontario Power Co., the Fidelity Electric Power Co., and the Niagara, Lockport & Ontario Distribution Co., these interests later being sold to the government. It was as chief of staff of engineers of New York State that he won his commission.

HARRY H. HAMILTON, civil and chemical engineer, was killed Oct. 10, by falling into a vat of boiling chemicals at the St. Louis Coke and Chemical Works, where he was employed. Mr. Hamilton was 30 years old. He was a resident of Portland, Ore., and graduated in 1912 from the Oregon Agricultural College. He was an enlisted marine officer and saw service in France during the war.

COL. JAMES A. MCCREA, since 1920 vice-president of the Pennsylvania R.R. system in charge of the Central Region, died of pneumonia Oct. 17 in Allegheny, Pa., aged 48 years. Colonel McCrea, the son of the late James McCrea who was president of the Pennsylvania R.R. from 1907 to 1913, entered the service of this railroad in 1895, after graduation from Yale University, and rose rapidly from rodman to engineer of maintenance-of-way of the lines east, then was made superintendent of the Cincinnati Division and later was general manager of the Long Island lines. He served in France 1917 to 1919, first as general manager of transportation, then as a member of the general staff of the A. E. F., and was awarded a Distinguished Service Medal.

From the Manufacturer's Point of View

A Point of Contact Between Maker and User of Construction Equipment and Materials

Export Ratios Need Study in Industrial Machinery Field

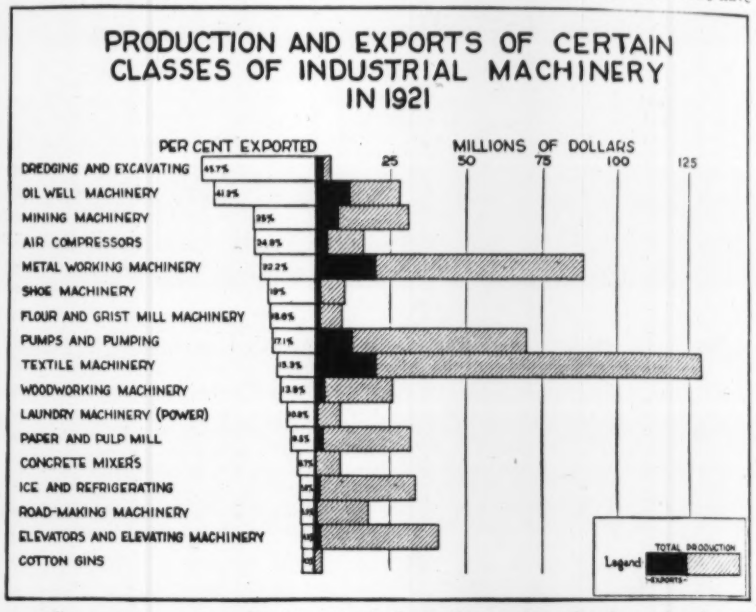
Virtual Withdrawal of German Goods Offers Opportunity to American Manufacturers

MANUFACTURERS of air compressors, according to statistics compiled by the Department of Commerce, have a better export business than manufacturers of concrete mixers. At first thought, according to an analysis of export ratios for various types of equipment by W. H. Rastall, chief of the department's industrial machinery division, one might expect the advantage to lie with the concrete-mixer manufacturer because of the nature of the work and the surroundings under which his product is commonly employed.

Why, Mr. Rastall asks, should the percentage of export orders secured by a manufacturer of excavating machinery be twice as great as that of a manufacturer of machine tools? American excavating machinery usually represents a high state of engineering development. These units are frequently very costly and one might expect that the labor conditions in most foreign countries would make it unnecessary to employ machinery of this character, while machine tools are necessary for a great number of manufacturing operations and would seem to be in more general demand.

A great many similar questions naturally arise in considering the accompanying chart, which indicates the total volume of production and the percentage exported applying to certain classes of American industrial machinery, and it is interesting to speculate whether the situation illustrated by this diagram is the result of fundamental conditions or merely expresses the comparative business activity and sales effort manifested by the management of these different producers of machinery.

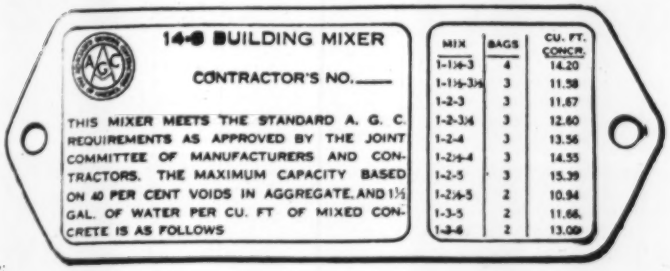
Conditions have now reached a point, according to the Department of Commerce, where American machinery manufacturers should give careful attention to their export business. Unusual opportunities are to be found in these foreign fields because Germany appears to be almost eliminated as a competitor. Before the war Germany furnished perhaps 45 per cent of the machinery that went into international trade and since the armistice there have been times when the depreciated condition of the mark gave German manufacturers a peculiar advantage in this trade. That situation has now passed and in great measure German prices already exceed world-market levels. Experience shows that deliveries from German manufacturers are slow and frequently uncertain, and in a great many ways it is difficult for foreign buyers to buy in Germany on a basis that is at all satisfactory. Business that formerly went to Germany will more and more fall into other hands.



Although there are a number of countries in the world that produce machinery for export, the countries of most outstanding importance at present are Great Britain and the United States, and the indications are that the large volume of machinery business formerly secured by German manufacturers will now be awarded to either British or American producers.

QUALITY SHOULD BE BASIS

American engineering and American machinery are distinguished in the world's markets for their superiority. Americans are noted for their engineering achievements, but, because of this superiority, American machinery is


14-S BUILDING MIXER
CONTRACTOR'S NO.
THIS MIXER MEETS THE STANDARD A. G. C. REQUIREMENTS AS APPROVED BY THE JOINT COMMITTEE OF MANUFACTURERS AND CONTRACTORS. THE MAXIMUM CAPACITY BASED ON 40 PER CENT VOIDS IN AGGREGATE, AND 1½ GAL. OF WATER PER CU. FT. OF MIXED CONCRETE IS AS FOLLOWS
MIX BAGS CU. FT. CONCR.
1-1½-3 4 14.20
1-1½-3½ 3 11.58
1-2-3 3 11.67
1-2-3½ 3 12.60
1-2-4 3 13.56
1-2½-4 3 14.55
1-2-5 3 15.39
1-2½-5 2 10.94
1-3-5 2 11.66
1-3-6 2 13.09

Rating Plates for Standard Concrete Mixers

Showing ratings and maximum capacities for standard sizes of concrete mixers, as adopted by the Joint Committee on Construction Equipment at Chicago, July 30, plates of which a sample is shown herewith, have been designed at the request of manufacturers for attachment to the machines to avoid any misrepresentation, over-rating or under-rating of mixers. It is announced by the Associated General Contractors that new plates will begin to appear on equipment as soon as the different manufacturers can arrange their designs and shop practices to conform with the new standards. Complete standardization is to be achieved before January, 1925.

The sizes of paving and building mixers adopted as standard are as follows:

Paving Mixers	Building Mixers	
21-E	21-S	5-S
13-E	28-S	7-S
7-E	14-S	3½-S

Portland Cement Output

Monthly output records for the portland cement industry in the United States were broken during September when mills produced a total of 13,109,000 bbl. as compared with 11,424,000 bbl. in September of last year. Shipments for September, 1923, were 13,698,000 bbl., which is higher than for the same month a year ago, but less than for certain other months in 1922 and 1923. The foregoing figures are based on statistics issued by the Department of the Interior and prepared under the direction of Ernest F. Burchard, of the Geological Survey, from reports by portland cement producers.

For the first nine months of 1923 portland cement production totaled 101,016,000 bbl. as against 81,563,000 bbl. for the same period during 1922.

Shipments for the first nine months of 1923 totaled 104,607,000 bbl., a gain of 15,923,000 bbl. over the same period for 1922.

Mixer Chokes on Contractor's 1: 2: 5 Charge

One of the Koehring Co.'s customers complained about the inability of the "Dandie" mixer to hold a 1:2:5 mix. A representative was sent out to investigate. He reported that the contractor was very much "peeved" and that the machine was certainly slopping. On investigation, however, he discovered that the contractor's conception of a 1:2:5 mix was one bag of cement, two wheelbarrows of sand and five wheelbarrows of stone. The contractor was complaining because the mixer wasn't big enough to take an extra wheelbarrow or two occasionally when the inspector was not looking.

Figures Show Scope of Brick, Tile and Terra Cotta Industry

The Department of Commerce announces that, according to reports made to it, the value of products of establishments engaged primarily in the manufacture of brick, tile, terra-cotta, fireclay products, pottery, and non-clay refractories amounted to $335,518,035 in 1922, as compared with $278,492,385 in 1921, $388,746,923 in 1920, and $286,261,276 in 1919.

For brick, tile, terra-cotta, and fireclay products the value reported for 1922 was $229,435,610, which was an increase of 23 per cent over 1921 and 16.2 per cent over 1919, but a decrease of 14.1 per cent compared with 1920.

For the pottery industry the value of products in 1922 was $91,986,297, which was an increase of 9.3 per cent over 1921 and 18.1 per cent over 1919, but a decrease of 13.8 per cent compared with 1920.

The reports for 1922 involve 1,973 establishments, including 1,651 primarily engaged in the manufacture of brick, tile, terra-cotta and fire-clay products, 270 primarily engaged in the manufacture of pottery, and 52 in the manufacture of non-clay refractories. Of the 1,973 establishments reporting in 1922, 331 were located in Ohio.

usually higher in price than similar equipment secured from foreign sources and must be marketed on a quality rather than a price basis. In other words, this trade, which formerly went to Germany, will now pass to British manufacturers unless American products are supported by constructive sales effort of such character as to demonstrate that American equipment is worth the price asked, and more. Manufacturers should now organize their sales effort along such lines as will accomplish this result.

Export business is becoming more and more essential to the prosperity of the individual manufacturer. The accompanying chart shows that it is vital for manufacturers of dredging and excavating machinery. The difference between a satisfactory or an unsatisfactory export ratio can easily represent the difference between profit and loss on the year's balance sheet. Manufacturers have a very definite opportunity to improve their export ratio, and it remains for them to make the sales effort necessary to secure these results. The present international situation provides an unusual opportunity.

Prepared Roofing Simplified

At a meeting held in Washington, D. C., Sept. 26 at the Department of Commerce with representatives of the Division of Simplified Practice and the Chamber of Commerce of the United States, manufacturers, distributors and consumers of prepared roofing agreed to the following simplifications as being of benefit not only to the industry but also to the public at large:

1. To eliminate all grades or kinds of slate-surfaced and also stone-surfaced prepared roofing that do not measure up to the requirements of the "Class C Label" of the Underwriters Laboratories.

2. To reduce the varieties of smooth surface roofing to seven lines or grades —weights and qualities being considered.

This Simplified Practice Recommendation is to become effective Jan. 1, 1924, and is to hold for one year.

According to W. A. Durgin, chief of the Commerce Department's Division of Simplified Practice, this is another step in the general program fostered by Secretary Hoover for the elimination of waste in industry. "The proposed eliminations," he said, "were strongly supported by the American Institute of Architects, the National Retail Hardware Association representing 21,000 retail hardware dealers throughout the United States, the National Retail Lumber Dealers Association, the Southeastern Builders' Supply Association, and the Prepared Roofing Association."

Several other simplifications of building materials have been completed notably common and face clay brick. Others in process of completion are lumber, hollow building tile, cement brick, block and tile and clay drain tile. All of these simplifications are contributing to the general effort to reduce the needless wastes in the building field.

Business Notes

KOEHRING CO., Milwaukee, has let contracts for an addition of 100 ft. to its light erecting shop to increase its output of cranes, draglines and power shovels. Plans for another new shop unit are now being drawn.

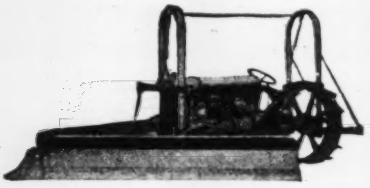
WESTINGHOUSE ELECTRIC & MANUFACTURING CO., at its South Philadelphia works, has established a general engineering division which will be devoted to the study of central station and industrial plant problems involving the application of steam power apparatus such as steam turbines, condensers and reduction gears. This department will also co-operate with the sales organization in providing engineering service to purchasers of this equipment.

REEVES BROTHERS CO., Alliance, Ohio, builders of steel tanks, oil refinery equipment, cement and mining machinery and creosoting plants announces, effective Oct. 1, an office at 2012 L. C. Smith Building, Seattle, Wash., from which all Western business will be handled. Percy E. Wright, consulting mechanical engineer, has been appointed assistant sales manager of the company and will be in charge of the office.

Equipment and Materials

V-Shaped Snow Plow on Tractor Clears Full Width of Road

Designed for attachment to the front end of a Fordson tractor, a new model of V-shaped plow for clearing snow from the full width of highways at one operation has been designed by the Stark Plow Co., 943 Little Building,



Boston, Mass. It consists of a pair of 2-in. oak-plank wings, each 10 ft. 6 in. long, shod with road-grader steel blades and hinged to a nose casting at the front end, as shown in the accompanying photograph. Each oak wing or moldboard is flared at the top, the total height of the blade being 20 in. As the tractor travels at speeds of from 12 to 15 miles per hour, this flareboard is effective in catching the snow as it rises up on the moldboard and throwing it over toward the sides of the road.

The wings are adjustable, by means of a trip latch and pin, and may be set to clear any width of roadway from 8 to 16 ft. One of the advantages of the V-shaped plow, its manufacturers point out, is the elimination of side thrust, making possible the clearing of a wider strip at one operation and a higher traveling speed. The equipment is designed so that in a heavy storm a route may be covered quickly, clearing the whole width on the outward journey and repeating on the inbound trip before the snow becomes too deep to handle.

To the tractor chassis are bolted two U-shaped hoisting frames rigged with block and tackle for raising and lowering the plow. The rear end of the tractor is equipped with a platform for an operator. The weight of the plow attachment is 1,200 lb. While designed primarily for tractor operation, the plow can be adjusted for use on a motor truck. In practice it has been found that the best results are secured by equipping the tractor with weighted wheels with 10-in. solid rubber tires equipped with chains.

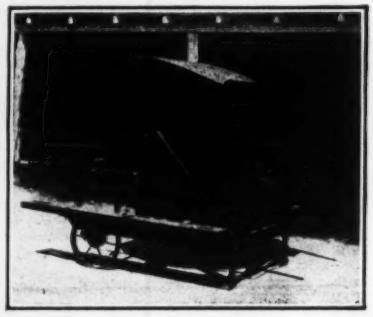
New Rust-Proofing for Wire

A new process termed "Galvannealing" for the application of a protective zinc coating to steel wire and wire fencing is being introduced by the Keystone Steel & Wire Co., Peoria, Ill., as an improvement upon ordinary galvanizing. The special advantage claimed is in permitting an extra heavy coat of zinc to be applied without fear of its flaking or peeling off. If such a heavy coating is applied by ordinary methods it is likely to separate from the steel when the wire is bent sharply, as in the weaving of fencing. In the new process, instead of employing pressure as usual to cause the zinc to adhere to the steel, the coated wire is given a heat treatment by which the zinc becomes amalgamated with the surface of the steel so that it will not crack or flake off when the wire is bent or twisted. It is claimed that steel wire and woven fencing thus made have fully twice the life of ordinary galvanized material.

Light, Compact Concrete Mixer Is Hand Operated

Operated by hand and weighing only 400 lb., a concrete mixer with a capacity of 6 cu.ft., known as the "Shaker," has been developed and placed on the market by G. W. Adams, concrete contractor, San Antonio, Tex. The equipment is designed particularly for mixer jobs that have heretofore been done by the shovel and board method or where a large gang is not justified for operating a larger and more expensive power mixer. Simplicity is the keynote in the design of the hand-operated machine which has been made compact, light, and portable.

As shown in the accompanying illustration, the device consists of a steel drum pivoted on ball bearings to a steel frame carried on a two-wheeled carriage. The mixer is charged directly from wheelbarrows and is frequently mounted directly over the forms so that it may discharge into them. In operation, after the charge has been introduced, the drum is rotated by hand,



back and forth in a semicircle. Blades on the interior of the drum throw the material to and from the sides and through two grates located about 5 in. on either side of the axis of the drum. The manufacturer of this equipment states that about a dozen revolutions or "shakes" of the drum are sufficient to produce a satisfactory mixture. The charge is emptied by revolving the drum about its axis until its mouth points downward. It is claimed that with a gang of four or five men the output of the machine will range from 20 to 30 cu.yd. daily.

Crane Handles 98-Ton Girder

At a highway bridge crossing over the main line of the Boston & Albany R. R. at Beacon St., Boston, a 98-ton steel plate girder was received on flat cars, unloaded and raised to place between train schedules, the operation beginning at 10 p.m. and ending at 1:55 a.m. The work was done by the Phoenix Bridge Co., which employed a crane manufactured by the Industrial Works, Bay City, Mich., for handling the large girder. It is claimed that this is the largest girder ever handled by a single locomotive crane.

A Self-Adjusting Wrench

A self-adjusting wrench requiring no screwing up or down to make it "bite" or fit an object is being marketed by the Greater Service Co., Newark, N. J. By the use of a ratchet leverage system the teeth are inclined to each other, causing the grip to be stronger as the pull is increased. The wrench, which is known as the Robert, is equipped with a spring, as shown in the accompanying illustration, and its operation requires the use of only one hand.

The wrench is made of drop-forged carbon steel in only one size, a 12-in. length, which weighs 1¼ lb. This size

will handle objects ranging from small nuts to 1¼-in. pipe. The manufacturer is planning shortly to put on the market additional sizes, from 6 in. to 15 in.

Publications from the Construction Industry

Kerosene Engines—FULLER & JOHNSON MANUFACTURING CO., Madison, Wis., has published a 40-p. illustrated catalog on its throttling governor kerosene engines in sizes from 3 to 25 hp. The text deals with both stationary and portable units.

Hammer Drills—SULLIVAN MACHINERY CO., Chicago, has issued a 32-p. revised illustrated bulletin on its Rotator hammer drills. The new models described include the lightweight and auger patterns, as well as the standard drills with solid or hollow pistons and air and water-jet attachments. The drills are one-man hammer drills, weighing from 29 to 40 lb., designed to drill holes from 8 to 12 ft. deep for 1¼-in. powder. They may be used as hand tools or on mountings.

Industrial Locomotives—BLOOMSBURG LOCOMOTIVE WORKS, Bloomsburg, Pa., has issued a 28-p. bulletin on its industrial locomotives of three types, a gasoline-engine-driven and two types of steam-engine-driven units. A feature of the gasoline locomotive is a mechanical speed control device working in connection with friction disk transmission. These units are built in sizes of 3, 4, and 6½ tons. The steam locomotives use oil fuel and the burners on the two models are of the vaporizing and the atomizing type. The oil-burning steam locomotives are particularly adapted to work where smoke and exhaust gases from internal combustion engines are objectionable, as in mines or tunnels.

Water for Swimming Pools—GRAVER CORP., East Chicago, Ind., in a 16-p illustrated pamphlet presents data on its filtration equipment for supplying pure water to swimming pools. The equipment for recirculating, filtering and sterilizing the water permits the same supply to be used over and over again. Actual layouts of typical swimming pools are presented. The Graver filters are of the mechanical pressure type.

Business Side of Construction

FACTS AND EVENTS THAT AFFECT COST AND VOLUME

Fifty Big Contracts Since March Total $157,460,646

Each week *Engineering News-Record* publishes a separate list of the large contracts awarded for the current issue. The accompanying table shows fifty large projects placed under contract during the period March 1 to Oct. 1, 1923. The list is composed of the largest awards taken from the various construction headings during these seven months and covers work in the United States and Canada.

This table gives the percentage of the various operations as follows: Buildings, 57%; Railroads, 9%; Streets and Roads, 4%; Waterworks, 3%; Sewers, 6%; Excavation and Dredging, 0.2%; Bridges, 2.7%; Dams, 5%; Power Plants, 13%.

The award for the railroad and telegraph system consisting of 330 mi. of track, a complete telegraph system and 660 mi. of fencing, amounting to $12,000,000 was given to the firm of Peterson, Shirley & Gunther, Omaha, Neb. A 30-story telephone exchange building in New York was awarded to Marc Eidlitz & Son, Inc., of New York City, for the sum of $11,250,000. The third largest contract is for the 16-story office and sales building at Chicago, Ill., and is being constructed by Wells Bros. Contruction Co. of Chicago for $8,000,000.

During this period the following number of contracts as reported in Construction News were awarded at the following prices (the amount quoted is the minimum taken as a base): 129 at $10,000; 2,771 at $25,000; 341 at $50,000; 2,044 at $100,000; 310 at $200,000; 184 at $500,000; 174 at $1,000,000; 14 at $5,000,000.

Business Briefs

Call money easy; rate 4@4½ per cent.

Time loans shows little variation during the last few weeks; 30, 60@90 day loans, to 6 months, 5@5¼ per cent.

Painting costs for the $868,529,000 worth of industrial and commercial building contracts noted in *Engineering News-Record* from Jan. 1 to Oct. 1 amount to $20,000,000, of which $8,000,000 is for paint materials. If one painter did all this work it would take him 2,740 years and he would receive $12 per day during that time.

British steel output up. September ingot production, 695,100 tons, against 567,500 in August. Pig-iron output, 558,600 tons, compared with 599,800 during preceding month.

American steel output drops. September production of steel ingots, 3,159,283 tons, against 3,506,755 in August. Daily pig-iron output, 104,184 tons, compared with 111,274, during preceding month.

Duty free building materials allowed by Turkish Government, to construction companies granted concessions for reconstruction of cities destroyed in Western Asia Minor.

ESSENTIAL DATA ON LARGE CONTRACTS AWARDED SINCE MARCH

Place	Work	Size	Price	Successful Contractors
Calif., San Francisco	Pipe line		$2,231,661	Western Pipe & Steel Co., 444 Market St., San Francisco, Calif.
Calif., Sacramento	Incinerator	150 ton	195,000	F. L. De Carie, Portland, Ore.
California	Bridge	11,731 tons struc. steel 2,150 cu.yd. con. floor 362,000 lbs. rein. steel for floor 27,300 cu.yd. con. piers 177,600 lb. rein. steel piers	4,500,000	Duncanson-Harrelson, Chronicle Bldg., San Francisco, Calif.
Calif., Los Angeles	Office	8 story	2,200,000	C. J. Kubach, 701 Merchants National Bank Bldg., Los Angeles, Calif.
Ill., Chicago	Sewer	Sewage treatment works	5,602,636	J. Griffiths & Son Co., 112 West Adams St., Chicago, Ill.
Ill., Chicago	Office and sales	16 story	8,000,000	Wells Bros. Construction Co., 53 West Jackson St., Chicago, Ill.
Ill., Chicago	Apartment	10 story, 124 x 269 ft.	3,500,000	B.-W. Construction Co., 720 Cass St., Chicago, Ill.
Ill., Chicago	Hotel	8 story, 200 x 216 ft.	2,000,000	Shank & Co., 30 North La Salle St., Chicago, Ill.
Ill., Chicago	Bank and office	21 story	5,500,000	H. Erickson Co., 139 North Clark St., Chicago, Ill.
Ill., Chicago	Office	20 story, 100 x 300 ft.	7,000,000	R. C. Wieboldt Co., 1534 West Van Buren St., Chicago, Ill.
Ind., Newburg	Lock		1,494,494	National Contracting Co., Citizens Bank Bldg., Evansville, Ind.
Ky., Danville	Dam	260 ft.	4,000,000	L. E. Meyer, Monadnock Bldg., Chicago, Ill.
Kentucky	Railroad	Grading, masonry for 16.63 mi. second track	1,799,579	Nichols Contracting Co., Georgia Bldg., Atlanta, Ga.
La., New Orleans	Dredging		350,200	Atlantic Gulf & Pacific Co., Park Row Bldg., New York City
Md., Baltimore	Filtration plant		1,070,000	Carozza-Rowe Construction Co., 624 North Gilmore St., Baltimore, Md.
Md., Baltimore	Grain elevator	206 x 61 x 240 ft.	3,000,000	M. A. Long Co., Guilford Ave. & Fayette St., Baltimore, Md.
Mich., Ann Arbor	Law school		2,000,000	Starrett Bros., Inc., 101 Park Ave., New York City
Mich., Battle Creek	Hospital		2,174,680	A. Bentley & Sons, 201 Belmont Ave., Toledo, Ohio
Missouri	Dyke		570,007	Kansas City Bridge Co., 510 Orear-Leslie Bldg., Kansas City, Mo.
Mo., Kansas City	Office	12 story, 132 x 143 ft.	2,225,000	Cherdron Construction Co., 603 McIntyre Bldg., Salt Lake City, Utah
Mo., St. Louis	Grain elevator	2,000,000 bu. cap.	2,000,000	Laclede Steel Co., Arcade Bldg., St. Louis, Mo.
Mo., St. Louis	Temple	5 story (equal to 14 story) 160 x 300 ft.	3,000,000	Westlake Construction Co., Ry. Exch. Bldg., St. Louis, Mo.
N. J., Camden	R.R. Terminal Bldg		2,000,000	New York Shipbuilding Corp., Bway & Fairview St., Camden, N. J.
N. Y., Brooklyn	Conduits		2,338,805	T. A. Gillespie Co., 7 Dey St., New York City
N. Y., Brooklyn	Siphon		1,523,136	Merritt, Chapman & Scott Corp., 17 Battery Place, New York City
N. Y., Long Island City	Sewer		528,002	Booth and Flinn, Ltd., Green and Tompkins Aves., Brooklyn, N. Y.
N. Y., Buffalo	Sewers		1,379,233	F. L. Cohen, Inc., Prudential Bldg., Buffalo, N. Y.
N. Y., New York	Subway		5,976,000	P. McGovern, Inc., 50 East 43rd St., New York City
N. Y., Brooklyn	School		2,492,000	G. A. Fuller, 175 Fifth Ave., New York City
N. Y., New York	School		2,057,950	G. Dekempie, 30 Church St., New York City
N. Y., New York	Telephone Exchange	30 story	11,250,000	Marceidlitz & Sons Inc., 42 East 42nd St., New York City
N. Y., New York	Office	24 story, 62 x 22 ft.	5,000,000	S. S. Roth & Bros., 130 West 42nd St., New York City
N. Y., Glens Falls	Dam	Dam and power house	1,000,000	Parklap Construction Co., Glens Falls, N. Y.
O., Cleveland	Coagulation basin		1,365,425	Stange-Walsh Constr. Co., 2315 Fairmont Rd., Cleveland, O.
O., Cleveland	Road work	56,450 sq.yd. grading and asphalt paving	311,059	Cleveland Trinidad Paving Co., The Arcade, Cleveland, O.
O., Cleveland	Hotel	16 story, 132 x 200 ft.	3,000,000	Crafts Construction Co., Sloan Bldg., Cleveland, O.
O., Cleveland	Library	4 story, 199 x 216 ft.	4,000,000	Lundoff-Bicknell Co., 5716 Euclid Ave., Cleveland, O.
Okla., Muskogee	Power plant	2 story	3,000,000	Oklahoma General Power Co., Muskogee, Okla.
Ont., Timmins	Hydro-electric plant		5,000,000	William Arrol & Sons, Ltd., St. Catharines, Timmins, Ont.
Pa., Springdale	Power plant		6,000,000	Sanderson & Porter, 52 William St., New York City
Pa., Pittsburgh	Piers and Abutments		854,692	H. C. Converse & Co., Devonshire St., Boston, Mass.
Pa., Philadelphia	Hotel	26 story, 100 x 260 ft.	7,000,000	G. P. Pawling & Co., 1432 South Penn Sq., Philadelphia, Pa.
Quebec	Power plant		3,000,000	Morrow & Beatty, Peterboro, Ont.
Que., Montreal	Apartment	10 story, 214 x 252 ft.	5,000,000	Anglin-Norcross Ltd., Victoria St., Montreal, Que.
R. I., Pawtucket	Transmission Line		1,400,000	Stone & Webster, Inc., 147 Milk St., Boston, Mass.
Tex., Ft. Worth	Sewers	2 filter beds	400,000	McKinzie Construction Co., 302 West Mulberry St., San Antonio, Tex
Wash., Seattle	Roadwork	23,050 sq.yd. 8 in. con. 750,000 cu.yd. excav. 646,000 cu.yd. earth excav.	571,087	Puget Sound Bridge & Dredging Co., Central Bldg., Seattle, Wash.
Wash., Seattle	Hotel		4,000,000	Grant-Smith & Co., Henry Bldg., Seattle, Wash.
Wyo., Rawlins	Waterworks	40 mi. 16 in gravity pipe	600,000	Continental Pipe Mfg. Co., 4519 14th St., N. W. Seattle, Wash.
Wyoming	Railroad & telegraph	330 mi. R.R. telegraph system, 660 mi. of fencing	12,000,000	Peterson-Shirley & Gunther, 1411 Woodmen of World Bldg., Omaha Neb.
Total			$157,460,646	

Storm and flood are the chief causes for the decline in crude oil output. Production for week of Oct. 13 was 2,125,350 bbl. against 2,157,400 bbl. of previous week.

Bids Wanted on Big Jobs

Among the projects on which bids are either asked or will soon be called for in Construction News, pp. 227 to 238, are the following:

Capitol, Charleston, W. Va., $2,500,000.

Water Plant, St. Louis, Mo., $2,500,000.

Hospital, San Francisco, Calif., city and county, $1,750,000.

Hotel, Louisville, Ky., Citizens Hotel Co., $2,300,000.

Hotel, Memphis, Tenn., Southern Hotel Co., Inc., $3,000,000.

Theatre and Office, Indianapolis, Ind., Monument Circle Realty Co., $1,500,000.

Large Contracts Let During Week

Among the week's announcements of contracts awarded in Construction News, pp. 227 to 238, are the following:

Hospital, Louisville, Ky., to Struck Construction Co., $1,500,000.

Bank and Office, Los Angeles, Calif., to Scofield Eng. & Constr. Co., about $1,250,000.

Hospital, New York, N. Y., to Nat. Constructors & Engineers, $1,000,000.

Warehouse, Chicago, Ill., to J. Bhedden & Co., $1,000,000.

Factory, Jacksonville, Tenn., Du Pont Fibre Silk Co., $4,000,000.

Weekly Construction Market

THIS limited price list is published weekly for the purpose of giving current prices on the principal construction materials, and of noting important price changes on the less important materials. Moreover, only the chief cities are quoted.

Valuable suggestions on costs of work can be had by noting actual biddings as reported in our Construction News section.

The first issue of each month carries complete quotations for all construction materials and for the important cities. The last complete list will be found in the the issue of Oct. 4; the next, on Nov. 1.

Steel Products:	New York	Atlanta	Dallas	Chicago	Minneapolis	Denver	San Francisco	Seattle	Montreal
Structural shapes, 100 lb.	$3.64	$4.00	$4.20	$3.40	$3.55	$4.20	$3.60	$4.10	$4.00
Structural rivets, 100 lb.	4.40	4.75	4.90	3.75	4.25	5.30	5.00	4.25	6.00
Reinforcing bars, ¾ in. up, 100 lb.	3.54	3.50	—3.38	3.20	3.45	3.85	3.65	4.10	3.90
Steel pipe, black, 2½ to 6 in. lap, discount	44%	53%	43%	47%	53–5%	36%	33.2@42.2%	35%	47.43
Cast-iron pipe, 6 in. and over, ton	63.60	54.00	—61.00	60.20	60.50	69.00	62.00	62.00	60.00
Concreting Material:									
Cement without bags, bbl.	2.70@2.80	2.60	2.05	2.20	2.50	2.84	2.61	2.90	2.25
Gravel, ¾ in., cu.yd.	1.75	1.85	2.38	2.00	1.85	1.90	2.15	1.25	1.50
Sand, cu.yd.	1.25	1.24	2.00	2.00	—1.00	1.00	1.50	1.25	1.25
Crushed stone, ¾ in., cu.yd.	1.75	2.00	2.83	2.00	2.00	3.50	2.15	3.00	1.90
Miscellaneous:									
Pine, 3x12 to 12x12, 20 ft. and under, M.ft.	62.00	39.00	52.25	58.50	44.75@45.75	48.00	41.00	29.50	70.00
Lime, finishing, hydrated, ton	18.20	25.00	+23.50	20.00	25.50	24.00	22.00	24.00	21.00
Lime common, lump, per bbl.	3.00@3.25	1.60	+2.00	1.50	1.50	2.70	2.10	2.80	9.50
Common brick, delivered, 1,000	22.40@23.65	11.00	11.60	11.00	17@19	12.00	15.00	15.00	16.50
Hollow building tile, 4x12x12, per block	Not used	.102	.115	.0724	.0816	.065	.....	.11	.115
Hollow partition tile 4x12x12, per block	.1179	.102	.115	.....	.....	.065	.108	.11	.....
Linseed oil, raw, 5 bbl. lots, gal.	.98	1.00	1.08	1.14	1.02	1.12	+1.11	.86	1.38
Common Labor:									
Common labor, union, hour	.75	.35	.....	.....	.....	.50@.55	.55	.....	.....
Common labor, non-union, hour	....	.30	.30@.50	.82½	.50@.55	.35@.50	.50	.56¼@.62½	+.30@.35

Explanation of Prices—Prices are to contractors in carload lots unless other quantities are specified. Increases or decreases from previous quotations are indicated by + or — signs. For steel pipe, the prevailing discount from list price is given: 45-5% means a discount of 45 and 5 per cent. Charge is 15c. per 100 lb. for cutting reinforced steel into 2-ft. lengths or over.

New York quotations delivered, except sand, gravel and crushed stone, alongside dock; common lump lime, in 280-lb. bbl. net, and hydrated lime f.o.b. cars; tile "on trucks"; linseed oil and cast-iron pipe f.o.b.

Labor—Concrete laborers' rate, 93¾c.; building laborers (pick and shovel men) 75c. per hr.

Chicago quotes hydrated lime in 50-lb. bags; common lump lime per 180-lb. net. Lumber delivered on job.

Minneapolis quotes on fir instead of pine. Brick, sand and hollow tile delivered. Cement on cars. Gravel and crushed stone quoted at pit. We quote on brown lime per 180-lb. net; white is $1.80 for Kelly Island and $1.70 for Sheboygan. Common labor not organized.

Denver quotes on fir instead of pine. Cement "on tracks"; gravel and sand at pit; stone on cars; lime, brick, hollow tile and lumber on job. Tile price is at warehouse. Linseed oil, delivered, in iron bbl. Common lump lime per 180-lb. net.

Atlanta quotes sand, stone and gravel per ton instead of cu.yd. Common lump lime per 180-lb. net.

Dallas quotes lime per 180-lb. bbl. Steel, cement, cast-iron pipe and crushed stone f.o.b. cars, other materials delivered.

San Francisco quotes on Heath tile, size 5½ x 8 x 11½. Prices are all f.o.b. warehouses except C. I. pipe, which is mill price plus freight to railway depot at any terminal. Common lump lime per 180-lb. net. Lumber prices are to dealers in yards at San Francisco, for No. 1 fir, common.

Seattle quotes on Douglas fir (delivered) instead of pine. Lump finishing lime per 180-lb. net. Hollow building tile delivered. Hydrated lime in paper sacks. Sand and gravel at bunkers.

Montreal quotes on pine lumber. Sand, stone, gravel and lump lime per ton. Cement, lime and tile are delivered; sand, gravel and stone on siding; brick f.o.b. plant; steel and pipe at warehouse. Hollow tile per ft. Cement price is in Canadian funds (the Canadian dollar stands at 98.58). Bag charge is 80c. per bbl. Discount of 10c. per bbl. for payment within 20 days from date of shipment. Steel pipe per 100 ft. net; 3-in., $47.43; 6-in., $119.

Changes Since Last Week

While there has been a perceptible falling off in demand for iron, steel and textiles, activity continues in other materials with but little tendency toward an upward turn in prices.

Fabricated structural steel bookings fell off nearly 12 per cent and steel castings, 6 per cent, during September. Confidence in the trend of business, however, is evidenced by the recent heavy demand for railroad materials. The Baltimore and Ohio Railroad Co. has placed orders for 50,000 tons of steel rails to be delivered during 1924. Including track fastenings, etc., the cost of this material will approximate $4,300,000. This tonnage has been distributed as follows: Carnegie Steel Co., Pittsburgh, Pa., 25,000 tons; Illinois Steel Co., Gary, Ind., 4,000 tons; Cambria Steel Co., Johnstown, Pa., 10,000 tons; Inland Steel Co., Indiana Harbor, Ind., 3,000 tons; Bethlehem Steel Co., Steelton, Pa., 8,000 tons.

Building materials prices show little tendency to change. Of the nine cities reporting weekly to *Engineering News-Record*, but three show any revisions. Dallas reports a decline of 62c. per 100 lb. in reinforcing bars and $2 per ton in cast-iron pipe. An advance of $3.50 per ton, however, is quoted in hydrated lime and 25c. per bbl. in common lump lime. A slight tendency to quote lower cement prices is prevalent in San Francisco and other points on the West Coast, due mostly to importations of foreign cement. Linseed oil rose 4c. per gal. in San Francisco during the week. Montreal shows a tendency toward higher rates for common labor; and firmness in black steel pipe.